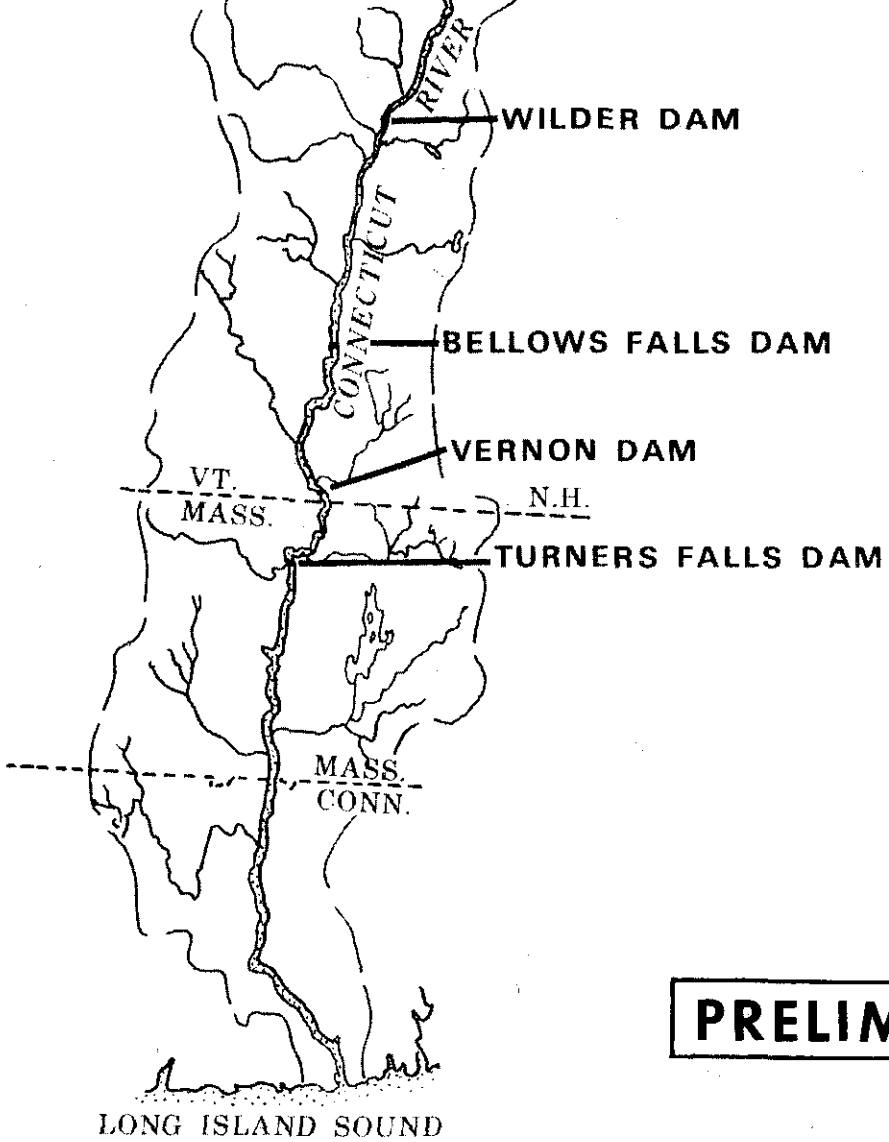
L. Bergen

WATER RESOURCES INVESTIGATION

CONNECTICUT RIVER STREAMBANK EROSION STUDY

PRELIMINARY REPORT



PRELIMINARY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

DECEMBER 1976

49

WATER RESOURCES INVESTIGATION

W.R.I.

CONNECTICUT RIVER

STREAMBANK EROSION STUDY

PRELIMINARY REPORT

Department of the Army
New England Division, Corps of Engineers
Waltham, Massachusetts

December 1976

SYLLABUS

Public concern over streambank erosion problems along the Connecticut River in New Hampshire, Vermont and Massachusetts was brought to the attention of the Congress. The ensuing Congressional resolution directed the Corps of Engineers to undertake an investigation to determine the cause of erosion behind the four hydroelectric dams, and whether the operation of the four hydroelectric facilities was a major factor in causing the problem. The study will include all causative factors such as weathering, raising or lowering of lake levels, wave action, river velocities, sedimentation conditions, type of soils, frost effects, vegetation cover and root patterns.

Several test or index areas were selected for detailed soils, hydraulic and hydrologic studies. The test areas provide a variety of physical and geographical conditions which are typical of conditions throughout the study area. These areas have been, and will continue to be monitored to reveal, which of the variety of possible causative factors are actually acting on the river's banks to cause erosion.

The historical operation of the Wilder pool was scrutinized to determine if there has been a change in operational procedures and if the operation has been consistent through the years. A similar effort is now being carried out on the Turners Falls pool.

Flow velocities along the water/bank interface at two locations in the Wilder pool were computed, as were tractive forces on the bank. The computed forces were compared with known allowable tractive forces for the existing soil types so that predictions could be made to indicate whether water velocity alone was sufficient to cause erosion. Tables show that some historical flows in one area would have created a water velocity sufficient to cause erosion while other flows would not. Historical flows in another area were not sufficient to erode the bank.

Work on the pilot areas has not yet progressed to a point where a complete picture can be presented, however, the tables and charts provided in this preliminary report will be expanded, refined and applied to other areas during the remainder of the study.

Public interest and involvement in this study has thus far provided a considerable amount of information and suggestions. For instance valuable water level recordings were provided by two shoreline abutters. A suggestion that a second study area be located in Wilder pool was adopted. This second site has provided an excellent opportunity to compare the effect of vastly different hydraulic conditions acting on the streambank of a single pool.

It is sincerely desired that interested parties continue to provide critical review of this document and future work concerning this study.

TABLE OF CONTENTS

TABLES

FIGURES

PLATES

APPENDICES

A. PURPOSE

The purpose of the Connecticut River Streambank Erosion study is aptly expressed in the authorizing resolution adopted on 11 April 1974 by the Committee on Public Works of the United States House of Representatives, which is quoted in part as follows:

> "Resolved.... That the Board of Engineers for Rivers and Harbors is hereby requested to review the report on the land and water resources of the New England-New York Region, requested by the Flood Control Act of 1950 and published as Senate Document No. 14, Eighty-fifth Congress, First Session, to study the erosion problems behind Wilder, Bellows Falls, Vernon, and Turners Falls Dams and to make recommendations for any changes in the operation of the dams or such remedial measures as would minimize erosion in Wilder Lake and the banks of the Connecticut River downstream to Turners Falls in Massachusetts. The study should include any factors which might affect river bank erosion such as weathering, raising and lowering of lake levels, wave action, river velocities, sedimentation conditions, types of soils, frost effects, vegetation cover, and root patterns."

The mechanics of streambank erosion are being analyzed to determine what part rapid pool drawdown plays in the total erosion picture. It is recognized that the effect of rapid pool drawdown may range from non-existent to totally responsible for the problem at different reaches of river in the study areas. Erosion in most areas will, of course, be a function of several factors; waves (natural and man made), river velocity and stage, frost, ice, soil type and vegetative cover as well as rapid pool drawdown. This study is designed to factor out rapid pool drawdown as a cause of erosion, so that a prediction can be made to determine the extent to which the erosion problem would be corrected by stabilizing the hydroelectric pools. The term rapid pool drawdown as used here and throughout the report means a decrease in water level caused by the normal daily operation of hydroelectric pools. It is recognized that water levels may also change rapidly under natural conditions.

B. INTRODUCTION

1. Reports and Public Participation - The study got underway with a public meeting in Hanover, New Hampshire, on 30 April 1975. The Connecticut River Streambank Erosion, Plan of Survey, dated October 1975 described the methodology which was to be used to conduct the study. Several areas of the study were further defined in a Memorandum of the Corps of Engineers dated 29 December 1975 and a paper, Discussion of Study Pilot Areas, February 1976.

The study was discussed at a meeting which was organized and hosted by a group called, For Land's Sake. The public was invited to this meeting held on 4 February 1976 in Hanover, New Hampshire. The New Hampshire-Vermont chapter of the Soil Conservation Society of America had a guest speaker from the Corps at the group's 9 April 1976 meeting in Hanover to participate in a two way discussion of the project.

The Upper Valley Lake Sunapee Council, convened a round table meeting on 10 March at Dartmouth College to discuss the study and in particular the Plan of Survey. Proceedings of the meeting which included several suggestions were sent to the Corps. The Corps in turn replied to the proceedings by letter dated 4 May 1976.

2. Work Accomplished to Date - Work on the study, thus far, has been conducted almost entirely by the Corps. The extent to which rapid pool drawdown is responsible for in causing erosion in the study reach is an extremely complex problem. Two Branches within the Corps' Engineering Division have provided the technical input. The Water Control Branch has been conducting hydraulic and hydrologic studies while the Foundations and Materials Branch has been conducting the soils investigations. Both Branches have collaborated in determining the relationship of soil type and water movement to erosion.

The six pilot areas which are shown on Figure 1 have been selected and monitored under a rigorous program of data collection and analysis. These pilot areas have been systematically photographed and surveyed in the fall of 1975 and the spring and fall of 1976. Plane table topographic surveys were made along the top of the river bank and down the bank to the water line. River bottom elevations were

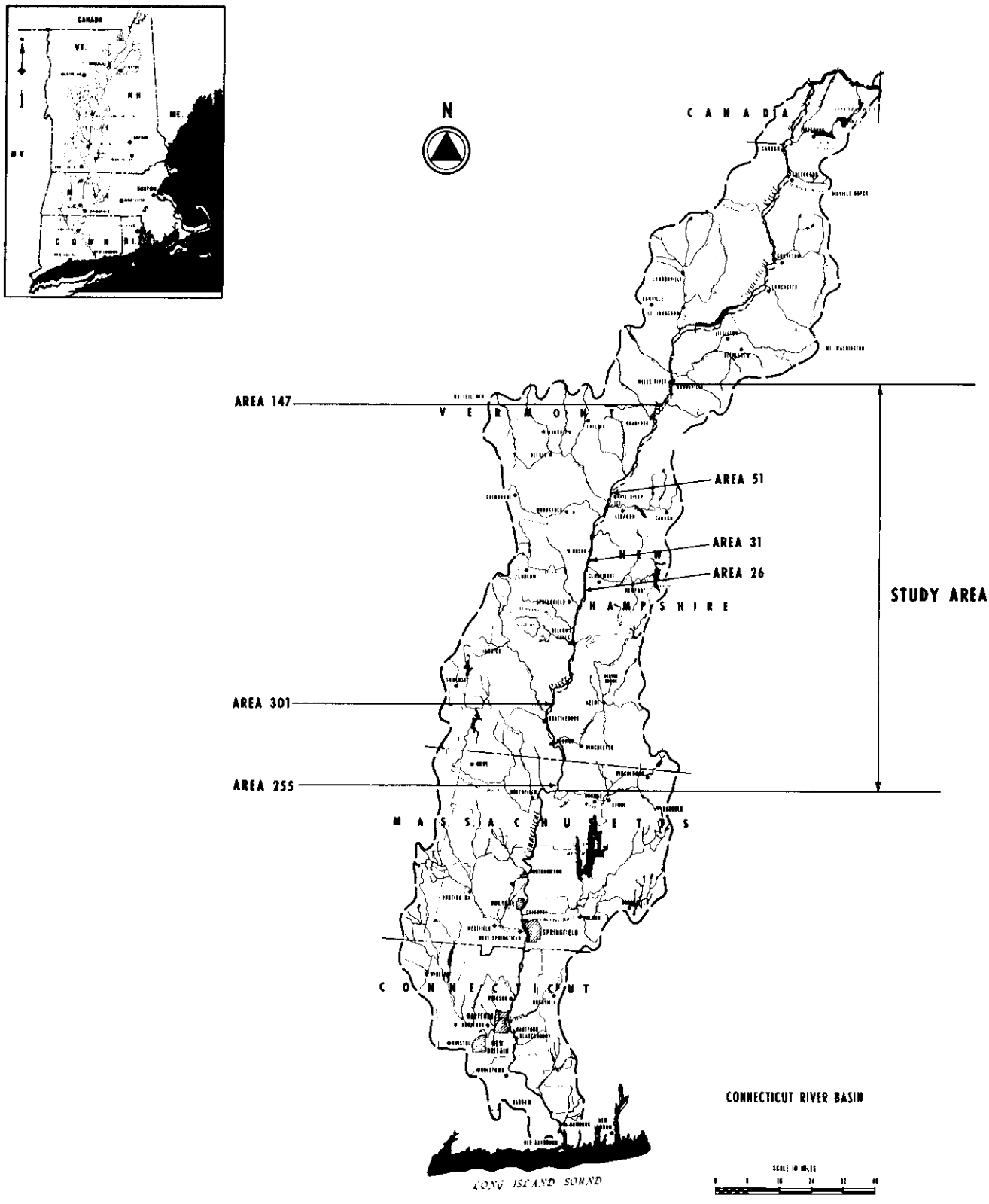

CANADA
VT.
N.H.
MASS.
CONN.
R.I.
N.Y.
ME.
N
CANADA
AREA 147
VERMONT
AREA 51
AREA 31
AREA 26
NEW HAMPSHIRE
STUDY AREA
AREA 301
AREA 255
MASSACHUSETTS
SPRINGFIELD
CONNECTICUT
LONG ISLAND SOUND
CONNECTICUT RIVER BASIN
SCALE IN MILES

FIGURE 1

obtained along river cross sections at 100 foot stations. The details of this work and preliminary observations are discussed later in this report. Both raw and interpreted data are provided in Appendix A.

3. Other Ongoing Related Efforts - The Corps of Engineers under Section 32 of Public Law 93-251, 7 March 1974 has been directed to construct demonstration streambank erosion control projects throughout the United States.

Two sites for the project have been tentatively selected in New England. Both sites are on the Connecticut River, one in Haverhill, New Hampshire, the other in Northfield, Massachusetts. The sites are on private property and were selected because they seem to be representative of many miles of streambank erosion in New England. Final selection of the sites depends, of course, on the cooperation of the landowners, the communities and the States.

Generally speaking, each of the sites contains about 2,000 feet of actively eroding streambank. The project would consist of subdividing each site into several sub-sections, perhaps 400-500 feet long. A different bank protective technique would be installed in each test sub-section. Vegetative cover, and various types of mechanical toe protection are being considered.

The purpose of the project is to experiment with new and perhaps innovative techniques of streambank protection. Techniques which are least expensive to install will get particular attention. This latter point is important because the project is to demonstrate methods that would also be suitable for local implementation.

Projects on the Mississippi, Missouri and Ohio Rivers were specifically authorized by the legislation and those projects are now underway. A general authorization was made for other projects in the United States and projects (including those in New England) have not yet been funded. It is now anticipated that the two projects on the Connecticut River will be funded in Fiscal Year 1978 up to 1980. The projects will be in operation within a year of the time they are funded.

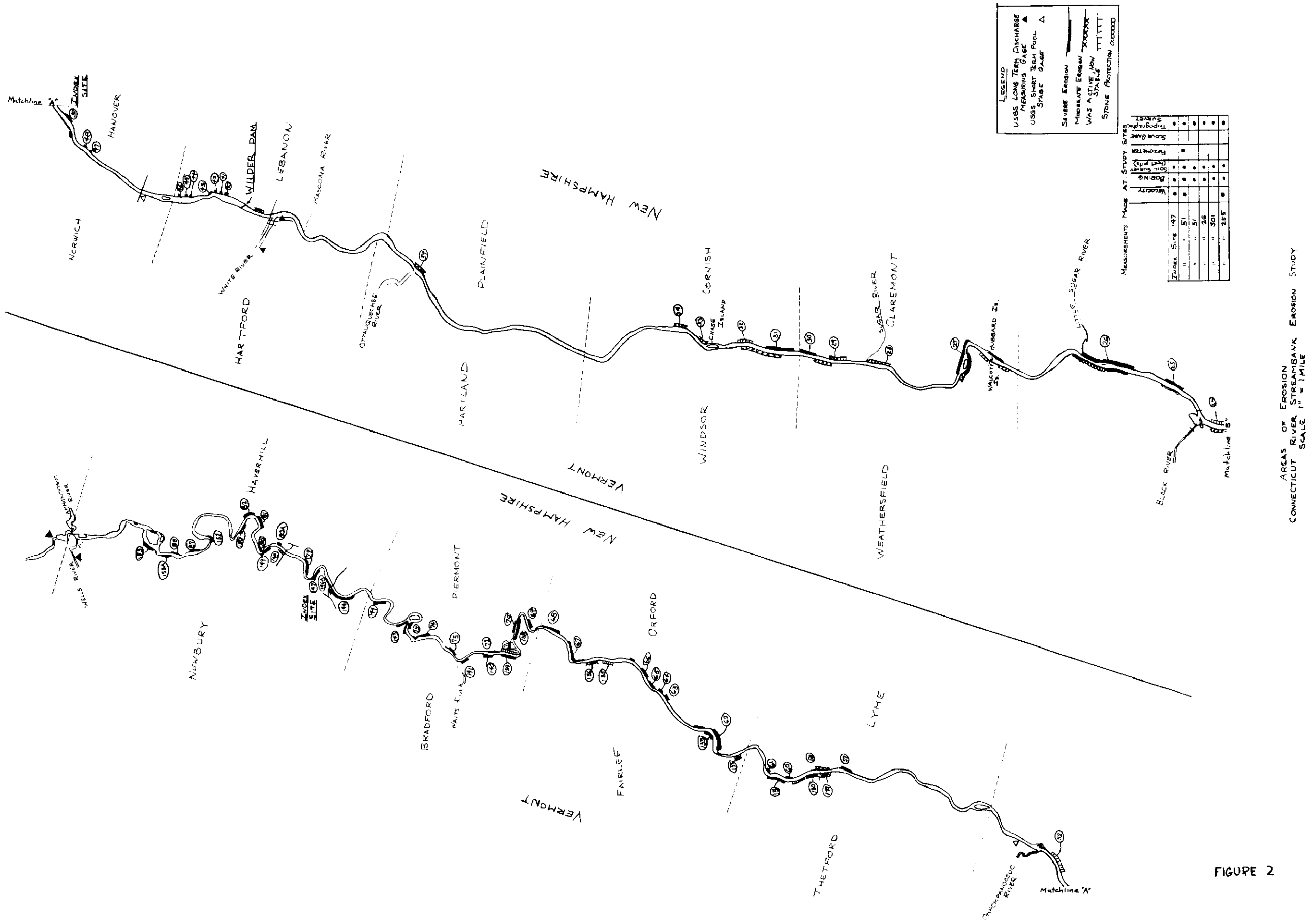
Another work unit of Section 32 provides for the monitoring of existing non-Federal projects. Several projects which have been constructed in the past and one that is currently underway will be examined to see if the technique used might have general application. A general description of the areas that the Corps has proposed for monitoring are included in Appendix B. It should be kept in mind that the Corps' Washington office will consider the proposed sites along with sites proposed by the Corps' other nine Division Offices in the nation. It is quite likely that some of the mentioned sites will be dropped in favor of similar sites elsewhere.

Several noteworthy attempts at erosion control have been initiated recently. One such non-federal attempt is that of Northeast Utilities which operates the Turners Falls project and the associated Northfield Mountain pumped storage facility. They have observed that considerable tree toppling and bank erosion extends over the nine river miles (eighteen miles of shoreline) between the French King Rapids and the Massachusetts, New Hampshire/Vermont state line. The company intends to clear trees that have toppled or are toppling from that eighteen miles of shoreline, hydroseed and mulch approximately nine miles of shoreline, grade and plant 1,500 - 2,000 feet of riverbank and riprap some 2,000 feet of riverbank.

Work on all phases except the hydroseeding were initiated this year. Hydroseeding is scheduled for the spring of 1977 and the remaining work will be completed in 1977 and 1978.

The company took a rather unique approach to the clearing of trees from the shoreline. The felled trees were picked up by a helicopter and dropped at a central point for grinding. Since most of the trees were in areas inaccessable by land, the company felt that the helicopter was the least costly approach. The program, because of the considerable cost, will be closely monitored by Northeast Utilities. The Corps will also be interested in the outcome of the program for possible application elsewhere.

The study reach is 141 miles long and contains over 300 miles of streambank. There are several hundred incidents of erosion in this study area of varying degrees of intensity. Incidents of erosion vary; in length from 100 to 7,000 feet; in average height from 2 to 50 feet and in intensity from slightly eroded to severely eroded. The principle areas of erosion are shown on the two sheets of Figure 2. The study detail which is necessary and the complexity of the study area make it impractical to consider each individual problem area. Index study areas



AREAS OF EROSION
CONNECTICUT RIVER STREAMBANK EROSION STUDY
SCALE 1" = 1 MILE
OCTOBER 1976

FIGURE 2

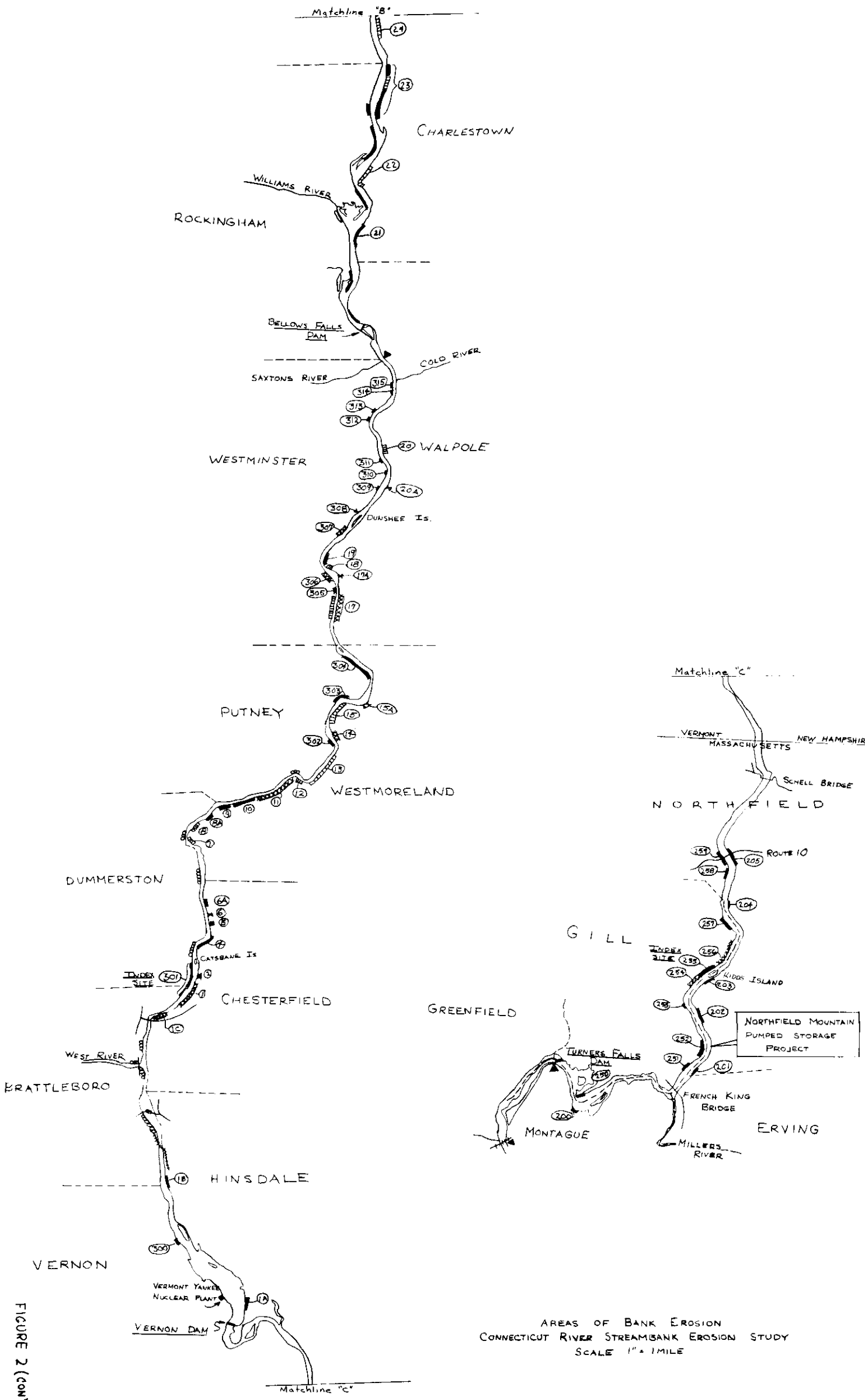


FIGURE 2 (CON'T)

AREAS OF BANK EROSION
CONNECTICUT RIVER STREAMBANK EROSION STUDY
SCALE 1" = 1 MILE

OCTOBER 1976

were established which are representative of conditions found throughout the study area. A rigorous examination of these index areas which are shown on Figure 1 is expected to provide information which can be applied to most of the remaining problem areas.

C. REPORT OF INVESTIGATIONS

The Connecticut River Streambank Erosion Study began in early 1975 with a search for available reports and photographs pertaining to erosion in the study reach. Two reports were found to be of use for this study: the Comprehensive Water and Related Land Resources Investigations, Connecticut River Basin, by the Connecticut River Coordinating Committee, June 1970; and the Reconnaissance Report on Connecticut River Basin Bank Erosion Study, by the New England River Basins Commission Technical Committee on Bank Erosion, 1 June 1974. Also found were aerial photographs of the entire study reach taken in 1939, photographs of the downstream portion taken in 1965, and the upstream portion taken in 1971 and 1973. More recent aerial coverage of the central part of the reach was not available.

With this information, a preliminary plan of action to investigate the extent and characteristics of erosion was established. It soon became apparent that extremely detailed hydrologic and soils analyses would be necessary if the causes of erosion were to be determined. Using data at hand, 16 candidate areas were chosen from which the index study areas would be selected. This procedure provided a starting point for the study as well as serving as a basis for evaluating the potential for aerial photography interpretation as a means of measuring erosion.

Field reconnaissance began in the spring of 1975 and has continued intermittently to date. About eight miles of river remain to be viewed. Practically all of the study reach viewed to date has been investigated by engineering personnel travelling the river by boat. The information gathered includes: the geographical location of the erosion, its position relative to the river (e.g., the outside of a bend, the inside of a bend, near an island, etc.), the types of soils in the raw area, the amount of vegetation, approximate height and length of the eroded area, bank slope or steepness, and its accessibility by land. This information was obtained for all significant eroded areas. Using these data, the final index study areas were chosen.

Principle factors in the selection of the index study areas were the hydraulic and soil conditions prevalent at the sites. Consideration was given in each case to the degree that the site would be representative of erosion characteristics throughout its respective reach, to the type of land use adjacent to the site, and to its accessibility by land.

Six index study areas were chosen and are shown on Figure 1. These are listed below in downstream order. The numerical codes given below will be used to identify each index study area throughout the remainder of this report.

Newbury, Vermont	(Area 147)
Hanover, New Hampshire	(Area 51)
Cornish, New Hampshire	(Area 31)
Claremont, New Hampshire	(Area 26)
Dummerston, Vermont	(Area 301)
Gill, Massachusetts	(Area 255)

Area 147 is located in the headwaters of the Wilder Pool on the outside of a riverbend adjacent to flood plain farmland. It has a surveyed length of 1700 feet and has a vertical face upper bank and a 1 on 1 slope lower bank. The water elevation fluctuates seasonally from about 20 feet below the top of the bank during low flow periods to overtopping during spring flows. This area was chosen because it typifies the eroded region of the upstream reach and is in an active stage of erosion. There is also easy access to the site by farm road. This is one of the three index study areas chosen in 1975.

Due to local public opinion, which felt that Area 147 did not have enough pool fluctuation to be representative of the entire length of Wilder Pool, another index site (Area 51) in Wilder Pool was chosen in the spring of 1976. It is located approximately six miles upstream from Wilder Dam and four miles upstream from an island which acts as a hydraulic control increasing the upstream surface profile during high flows. An attempt to locate a study area downstream from this natural control or closer to the dam was made, but no appropriate sites could be found. The study area is located on a straight section of river with part of its 500 feet length located within a cove in the river. This factor will facilitate the study of pool fluctuation as a potential cause of erosion and the determination of how much it contributes to the total erosion at this location.

Areas 31 and 26 were both selected in 1975 and are located in the reach between Wilder Dam and Bellows Falls Dam. Area 31 is located upstream from the Bellows Falls Pool during normal flow periods. However, during high flow periods river depths in the study area are greatly affected by backwater from the dam and this reach becomes a part of the Bellows Falls Pool. The upstream portion of the streambank is partially wooded

and abutted by forest. The downstream portion is relatively clear of trees and abuts open agricultural fields. The bank is 1000 feet long by about 45 feet high. It is situated on a straight section of the river adjacent to some sand and gravel bars which are exposed in the river channel during low flow periods.

Area 26 lies along the central segment of Bellows Fall Pool just downstream from Glidden Island and along a straight section of river. This is the longest of the index study areas, measuring 2,700 feet. Its bank ranges in height from 3 feet to 20 feet above the normal water surface level. The streambank abuts pasture land and agricultural fields and is readily accessible by vehicle. This area was selected because it is representative of much of the erosion within the Bellows Falls Pool. It is similar to area 31 in many ways except that it lies along a reach of the river that is permanently impounded.

In addition to Area 51, described above, two other index study areas (301 and 255) were selected in the spring of 1976. Area 301 is located along a straight section of river channel within the Vernon Dam Pool and lies just downstream from Catsbane Island. The 2,400 feet long by 20 feet high bank is in an active state of erosion and is resulting in the loss of portions of an agricultural field. Area 301 was selected for study because it is situated directly upstream from a riprapped area and thus provides a good comparison between erosion characteristics of a natural bank and an unnaturally strengthened bank.

Area 255 is located along the west bank of Turners Falls Pool approximately three miles downstream from the Route 10 bridge. This area is positioned on a straight section of river across from Kidds Island and is divided by Otter Run Brook, a small tributary stream flowing into the Connecticut River from the west. Though the area is not as actively eroding as the other index study areas, it was selected as being typical of conditions existing along most of the reach in which it lies. The Turners Falls Pool elevation was increased by 5.5 feet in 1971 to accommodate the additional volume needed to operate the Northfield Mountain Pumped Storage Hydroelectric facility. Another reason for selection is that, since operation of the Northfield Mountain project began, the pool has fluctuated 3 to 5 feet per day thus providing an opportunity to attempt to isolate the effects of extreme pool fluctuations and high water levels on bank erosion.

Areas 147, 26 and 31 were surveyed in the fall of 1975 and the spring of 1976; the remaining three areas (51, 301 and 255) were surveyed in the spring of 1976. Topographic maps of the index study areas were developed using a plane table and alidade. Ground and river bottom elevations were also taken at cross-sections spaced at 100-foot intervals along the streambank. Surveys of the same cross-sections will be made every six months so the loss or gain of material can easily be measured.

Soil borings at points located back from the edge of the bank and test pits along the raw banks have been completed at each index site. Two piezometers were installed at Area 51 in an attempt to correlate the fluctuating power pool with the groundwater table so that a determination of the effect that this phenomenon has on erosion can be made. Photographs have also been taken at reference points to keep track of the erosion rates in the index study areas. Periodic surveys will also continue with comparisons to the already plotted cross-sections.

Local velocities at the selected study sites have been either estimated, computed by the HEC Unsteady Flow computer program or measured by a current meter. Flow patterns, river levels and extent of eddy action were noted in field reports. No significant wave heights were observed during field trips because of the lack of boat traffic on weekdays and minimal wind speeds. Flows at the US Geological Survey stream gages have been analyzed to determine frequency of scour at the index sites. Pool stages have been recorded at each of the power dams in the study reach. In addition, water levels in the Wilder Pool have been recorded for a period of approximately a year at three locations by the USGS and at two other locations by private individuals. The analysis of the above data will be discussed in detail in the following section.

D. HYDRAULIC ANALYSIS

1. General - Flow along 118 miles of the 141-mile long study reach is impounded by four run-of-the-river power dams. Each of the pools created by these dams contains only enough usable storage to meet generation requirements on a daily basis. Pertinent data for these reservoirs is presented on Table 1. All four dams pass approximately 10,000 cfs during peak power demand periods and close down during the remainder of the day. Turners Falls Reservoir differs from the three upstream pools because in addition to being a run-of-the-river pool, it serves as the lower storage reservoir for the Northfield Mountain Pumped Storage Project. The gates at Turners Falls Dam were raised 7 feet in 1971 to accommodate the additional storage volume necessary to operate the Northfield Mountain facility, which was completed and began operation in October 1973.

Plots of pool stage versus time at the four power dams are presented on Plate 1. The curves indicate that the Vernon, Bellows Falls and Wilder Pools fluctuate in the order of a foot per day. However, the Turners Falls pool fluctuation is out of phase with the upstream pools and has a magnitude of fluctuation of 3.5 feet per day. Because of the great similarity in power operation, local flow conditions, and streambank materials at the three upstream dams, it was decided to perform extensive hydraulic analysis on Wilder Pool and to correlate the results with the Bellows Falls and Vernon pools. An independent analysis of historical power operations will be made for Turners Falls pool.

2. Wilder Pool Analysis - Normally inflows to Wilder Pool vary between 1,000 cfs and 5,000 cfs during the day because of the operation of upstream power and storage reservoirs. Wilder Dam turbines discharge 9,700 cfs during peak power periods and shut down completely during non-production periods. Because of the varying flow conditions, a computer program developed by the Corps Hydrologic Engineering Center and entitled "Gradually Varied Unsteady Flow Profiles" was used to calculate flow conditions throughout the entire pool during a typical period of operation. The period of 1-15 November 1972 was analyzed because it includes both continuous low flow and high flow periods. In addition, the USGS had maintained three water level recording gages on the Wilder Pool during that period. Data from these gages were used to calibrate the function coefficients used in the computer model. Pool profiles at two hour intervals were calculated using this program and are plotted on Plate 2.

WILDER POOL

BELLOWS FALLS POOL

VERNON POOL

TURNERS FALLS POOL

384
383
382
381
291
290
289
219
218
184
183
182
181
180
179
178

WATER SURFACE ELEVATION IN FEET ABOVE MEAN SEA LEVEL DATUM

20 SAT
21 SUN
22 MON
23 TUE
24 WED
25 THURS
26 FRI
27 SAT
JULY 1968

24 SAT
AUG 1974
25 SUN
26 MON
27 TUE
28 WED
29 THUR
30 FRI
31 SAT
AUG 1974

CONN. RIVER STREAMBANK EROSION STUDIES

POOL STAGE VERSUS TIME AT THE FOUR RESERVOIRS STUDY

OCT 1976

PLATE 1

VALLEY NEWS
WEST LEBANON, NH.
D. 11,743

FEB 25 1977

New England Newsclip

Corps Says Dam Not To Blame For Possible Erosion Increase

PAGE ONE

By ROB ELEY
Valley News Staff Writer

WEST LEBANON — An Army Corps of Engineers study released this week finds that possible increased erosion along the banks of the Connecticut River cannot be attributed to "more severe" operation of Wilder Dam.

The preliminary study, which opened with a public hearing in Hanover in April 1975 and is slated to continue through 1978, is aimed at studying erosion problems behind four power generation dams in New Hampshire, Vermont and Massachusetts. Wilder Dam is among those being studied.

The study is designed to "make recommendations for any changes in the operation of the dams or such remedial measures as would minimize erosion in Wilder Lake and the banks of the Connecticut River," according to the introduction.

The study has included the monitoring of six areas along the river, including sites at Hanover, Cornish and Claremont, and will establish two sites, one in Haverhill, to allow for demonstration of erosion effects on streambanks.

Sec 3 2

One of the preliminary report's major findings centers on the effect of the operation of Wilder Dam specifically whether more extensive "drawdowns" of the reservoir have exacerbated bank erosion.

Built in 1952, Wilder Dam holds back a so-called lake reaching 45 miles up the Connecticut River. Operation of the dam releases water usually between 11 a.m. and 6 p.m. for the generation of power.

"If erosion has been accelerating in recent years, it was due to either natural streamflow and groundwater conditions or wave action of increased power boat activity, but not as a result of a more severe operation of Wilder Dam," the preliminary findings report.

The report shows that the "drawdown," or the drop in the water level when power is being generated, has increased over the years.

In 1952, the water level dropped during generation over three-quarters of a foot, but in 1974 the level dropped a foot and three-quarters.

The increased fluctuations in the water level, however, "resulted from higher natural streamflow and not a change in the Wilder Dam operation procedure," the report said.

At the April 1975 public hearing "some local residents expressed their belief that the erosion in Wilder Pool has been accelerating in the last five or so years," the report said.

The study said information points to equally severe erosion along the river in aerial photographs made in 1939, 1971 and 1973.

Project manager John T. Smith, stationed at the New England Division of the Army Corps of Engineers in Waltham, Mass., said this morning that a major aspect of the continued study would be an effort to find the actual effect of dam operation on erosion.

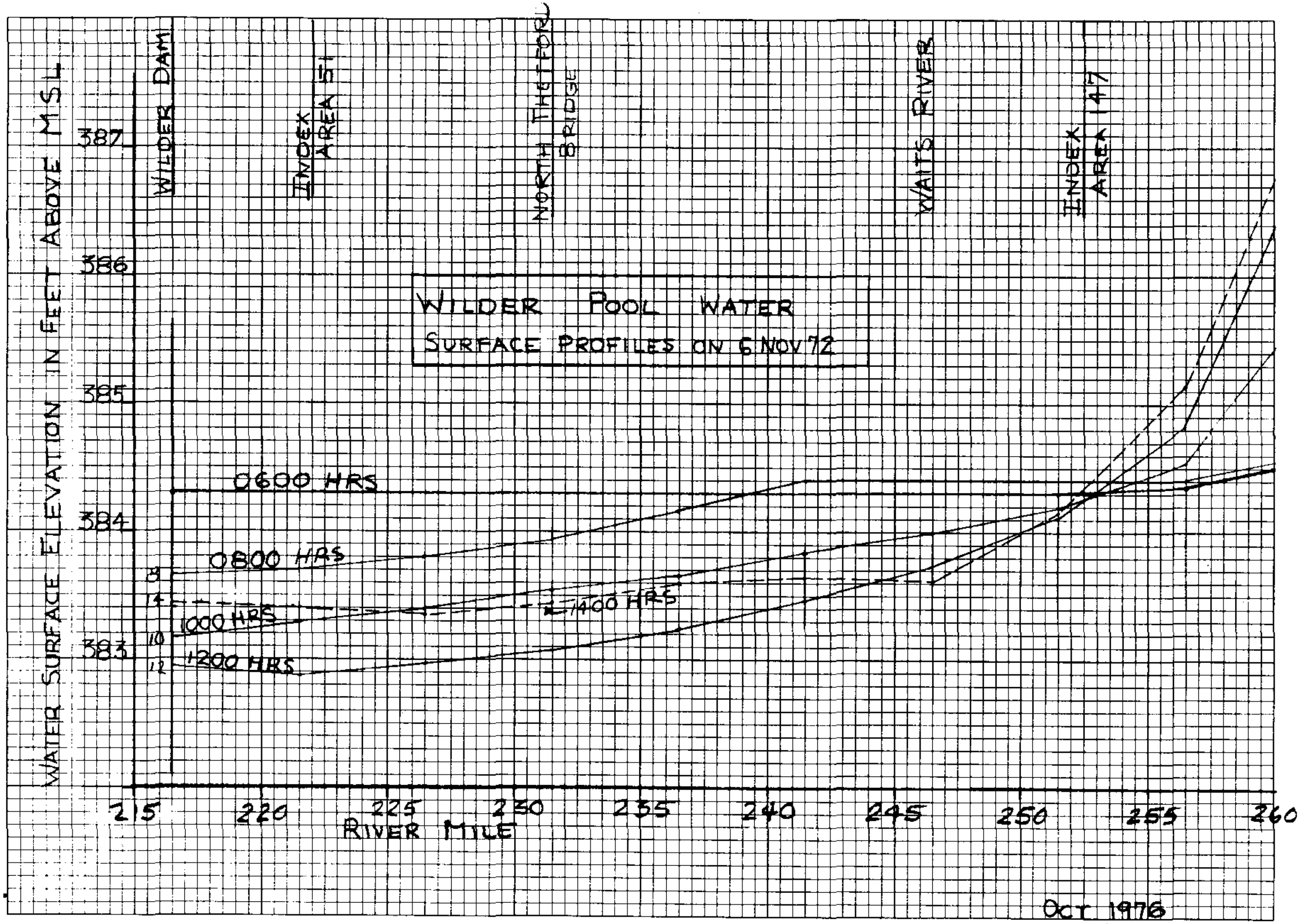
"We want to find out if stabilizing the reservoirs will solve the problem," Smith said.

In the future, he said, the Corps will continue to monitor the six areas along the river to see the dam's effects on erosion. erosion.

"If rapid drawdown proves to be a significant factor, then the practicality of stabilizing the power pools will be considered," the report said.

Any recommendations for a stabilization of the reservoirs would go first to the Federal Power Commission, since each of the dams is licensed by that agency.

See bg 2c 6b 7P



WILDER POOL WATER
SURFACE PROFILES ON 6 NOV 72
WATER SURFACE ELEVATION IN FEET ABOVE MSL
RIVER MILE
WILDER DAM
INDEX AREA 51
NORTH THETFORD BRIDGE
WAITS RIVER
INDEX AREA 147
0600 HRS
0800 HRS
1000 HRS
1200 HRS
1400 HRS
387
386
385
384
383
215
220
225
230
235
240
245
250
255
260
OCT 1976

PLATE 2.

TABLE 1

CONNECTICUT RIVER POWER DAMS
PERTINENT DATA

Dam	River Mile	Length of Reservoir (miles)	Full Oper. Elevation (ft msl)	Min. Oper. Elevation (ft msl)	Maximum Discharge for Power (cfs)	Approximate Daily Pool Fluctuation (feet)
Wilder	217.4	45.5	385.0	380.0	9,700	1.8
Bellows Falls	173.7	25.3	291.6	287.6	9,500	1.3
Vernon	141.9	27.7	220.1	212.1	10,400	0.6
Turners Falls	122.2	19.7	183.5	176.0	10,600	3.5

The analysis provided discharge and water surface elevations at index area 147 in Newbury, Vermont and area 51 in Hanover, New Hampshire. A detailed tractive force analysis was performed at the two locations to determine the effects both normal and high channel velocities have on the erosion of bank material. Recently completed hydrographic surveys and soil sample descriptions were used in the analysis. Plots of discharge, velocity and tractive force versus time during a typical low flow day are presented on Plate 3. It is noted that the velocity and tractive force values are higher at a bend than along a straight section of channel.

In 1926 several types of soils were tested by Fortier and Scobey to determine the maximum stream velocities the materials could withstand. Table 2 is a compilation of permissible velocities resulting from the Fortier and Scobey experiments and the correlative tractive forces as converted by the U. S. Bureau of Reclamation. The table shows that colloidal materials are less susceptible to erosion than the non-colloidal types; this is due to the higher cohesion between the soil particles. It also shows that it takes a greater tractive force to erode the materials if the water already contains colloids. According to the Fortier and Scobey's experiments, silt will withstand twice the velocity that sand can withstand. The velocities presented in the table are average values applied to channels of three feet or less in depth. Because these tabulated velocity values are pertinent to and reflect the geometry of the test flume in which they were measured, they cannot be compared with the velocities in the cross section of the large channel such as the Connecticut River. On the other hand, the correlative unit tractive force values shown on the table can be used in a comparison with tractive force values computed for the natural channel.

A laboratory analysis of the bank material at area 147 shows that the upper bank consists of a fine sandy silt and the lower bank which starts about eight feet above normal water level and continues down to the toe, consists of silty fine sand. Both materials are noncolloidal. The streambank at area 51 is composed of noncolloidal silty fine sand. At both of the above locations, a silty fine sand is the predominant material along the lower portion of the slope where the tractive force is the greatest. A value of 0.10 lbs./ft.^{2} was adopted from Table 2 for the allowable tractive force. The streambank materials at the index sites were not exactly described in this table, however, they did appear to fall somewhere between a sandy loam and an alluvial silt. It was assumed that the water passing these areas already contained colloidal silts.

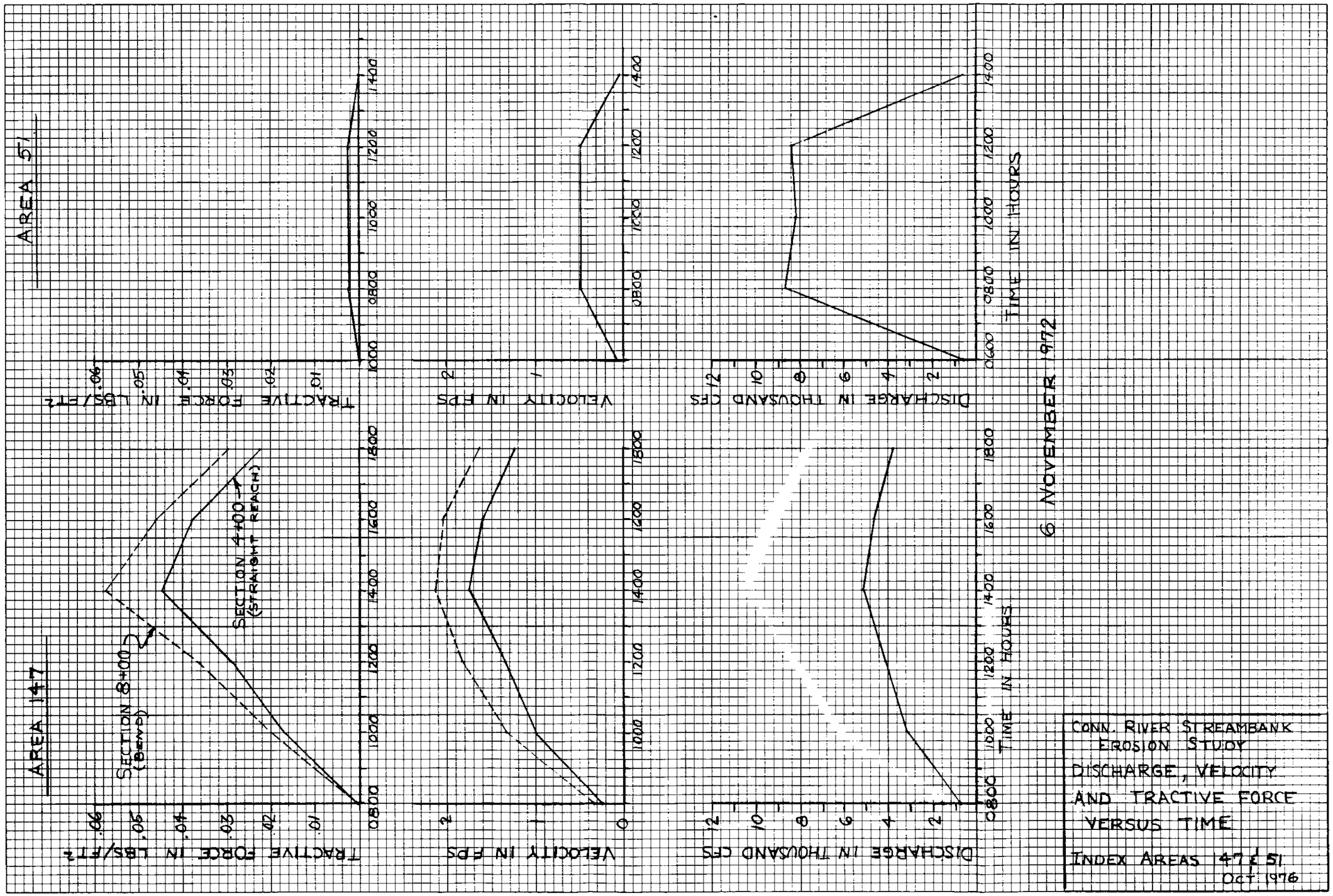

AREA 51
TRACTIVE FORCE IN LBS/FT²
VELOCITY IN FPS
DISCHARGE IN THOUSAND CFS
TIME IN HOURS
6 NOVEMBER 1972
AREA 147
SECTION 8+00 (BEND)
SECTION 4+00 (STRAIGHT REACH)
CONN. RIVER STREAMBANK EROSION STUDY
DISCHARGE, VELOCITY AND TRACTIVE FORCE VERSUS TIME
INDEX AREAS 147 & 51
Oct 1976

PLATE No. 3

TABLE 2

MAXIMUM PERMISSIBLE VELOCITIES
AND UNIT TRACTIVE FORCES (1)

Material	n	Clear Water		Water Transporting Colloidal Silts	
		V (fps)	To (lb/ft^2)	V (fps)	To (lb/ft^2)
Fine sand, colloidal	.02	1.50	.027	2.50	.075
Sandy loam, noncolloidal	.02	1.75	.037	2.50	.075
Silt loam, noncolloidal	.02	2.00	.048	3.00	0.11
Alluvial silts, noncolloidal	.02	2.00	.048	3.50	0.15
Alluvial silts, colloidal	.025	3.75	0.26	5.00	0.46
Fine gravel	.02	2.50	.075	5.00	.32

(1) From Chow "Open Channel Hydraulics" table 7-3 1969. Velocities adopted from Fortier and Scobey values recommended for use in 1926 ASCE publication. Unit tractive force converted by U.S. Bureau of Reclamation.

Table 3 gives the results of the tractive force analysis and the prediction of the streambank's susceptibility to erosion. A close look at the table indicates that tractive forces at area 147 are ten times as great as those values at area 51. It was determined by this analysis that during both normal low flow and rainstorm runoff conditions the tractive force is not great enough to initiate erosion. This was true at both areas.

During the 3-year frequency flood flow experienced in 2 April 1976, the tractive force at area 147 definitely exceeded the permissible values. Field observations and measurements confirmed the predicted erosion.

For area 51, under the 2 April 1976 high flow condition, the computed tractive forces fell short of the values required to initiate erosion and therefore the streambank was predicted to be stable. Three weeks after the above date, it was observed that the beach located at the toe of the bank and consisting of sandy silts did not move. This observation confirms the computed prediction. Visual observations indicated that pockets of active erosion and sloughing were present along the upper bank of the entire reach of area 51, which included slack areas of the cove. Based on the above observations, it appears that local tractive force did not erode the streambank materials. Future topographic surveys and analyses will be necessary to confirm or deny this preliminary conclusion. Other potential causes of erosion at this location are: fluctuating pool stages; wind and power boat waves; and ice action. Area 51 is subject to waves created by wind over open water having fetch lengths of 2,000 feet from the west and 3,000 feet from the northeast. Waves driven by 20 and 40 knot winds reached heights of 0.5 and 1.0 feet, respectively. Also, erosion due to ice action was observed in the southerly portion of the Wilder Pool. In the winter, while the pool is kept between the elevations of 382 to 384 feet msl, the water surface ice freezes onto the streambanks. Then during the spring runoff, the water level is lowered to 380 feet msl, causing the ice to fall and remove bank material. An attempt will be made to quantify the contribution by each of these causes at a later date.

In addition to the erosion forces, surface conditions such as the amount and type of vegetation play an important role in the stability of streambanks. At area 51 the upper bank is well vegetated with grass and

TABLE 3

RESULTS OF TRACTIVE FORCE ANALYSIS

Area 147
Silty fine sand (Noncolloidal)
Fine sandy silt (Noncolloidal)

Flow	Local Velocity (fps)	Tractive Force Computed (lbs/ft2)	Tractive Force Allowable (lbs/ft2)	Prediction[6]
5070 cfs [1] (6 Nov. 72)	2.3	0.058	0.10	No Erosion
12,100 cfs[2] (11 Nov. 72)	4.3	0.089	0.10	No Erosion
16,000 cfs [3] (21 April 76)	4.0[5]	0.15	0.10	Will Erode
42,000 cfs [4] (2 April 76)	7.2	0.89	0.10	Will Erode

Area 51
Silty fine sand (Noncolloidal)

Flow	Local[7] Velocity (fps)	Tractive Force[7] Computed (lbs/ft^2)	Tractive Force[7] Allowable (lbs/ft2)	Prediction[6]
8700 cfs [1] (6 Nov 72)	0.48	.002	0.10	No Erosion
12,200 cfs [2] (11 Nov 72)	0.85	.007	0.10	No Erosion

TABLE 3 (cont'd)

RESULTS OF TRACTIVE FORCE ANALYSIS

Flow	Local(7) Velocity (fps)	Computed (lbs/ft^2)	Allowable (lbs/ft^2)	Prediction(6)
16,000 cfs (3) (21 April 76)	1.1	.014	0.10	No Erosion
42,000 cfs (4) (2 April 76)	2.8	.07	0.10	No Erosion

(1) Normal weekday flow
(2) Typical rainstorm runoff
(3) Typical spring flow
(4) Three year discharge frequency
(5) Velocity confirmed by field measurement on that day
(6) Prediction based on tractive force
(7) Values of tractive force and velocity were adjusted to be consistent with field measurements

young trees which aid in retarding the erosion. However, at area 147, the upper bank is inundated annually by moderately high velocity flow which prevents vegetation from taking hold. A raw bank is much more susceptible to further extensive erosion than a vegetated bank.

3. Comparison of Present and Past Conditions - At public meetings held for this study, some local residents have expressed their belief that the erosion in Wilder Pool has been accelerating in the last five or so years. A close look at the following factors that can cause erosion was taken to determine if any were changed either by man or nature over the specified time period.

a. Streamflow - The average annual, average summertime and annual peak discharges were analyzed for the years 1959 through 1974. The results show that during the period 1964-1968 both the average annual and average summertime flows were low relative to their respective flows between 1969 and 1974; obviously a result of the mid-1960's drought. In addition, although the annual peak flows did not exceed 35,000 cfs between 1959 and 1968, since then this flow rate has been exceeded considerably on four separate occasions. Plots of the results are presented on Plate 4. In summary, both the normal and the erosive peak discharges have increased considerably since 1969.

b. Groundwater - As discussed earlier, future analyses will attempt to show the effect groundwater levels and flows have on erosion. However, in the interim the USGS groundwater level records were obtained at seven short term stations in Massachusetts, Vermont and New Hampshire and at a long term station located in Montague, Massachusetts. The lowest annual levels recorded at these stations are plotted on Plate 5. The graphs show that the Montague gage reached all time lows between 1964 and 1967 but has risen 4 to 5 feet since then. The short term gages located throughout the study reach also show a steady rise in groundwater levels since 1970.

c. Pool Stage - Pool stages at Wilder Dam have been recorded by the New England Power Company since construction of the project in 1952. Wilder Dam makes flow releases during weekday power demand periods, usually between 1100 and 1800 hours, and closes down for the remainder of the day and on weekends. Table 4 shows the average weekday pool fluctuations during the months of July and December for several three-year periods. This tabulation

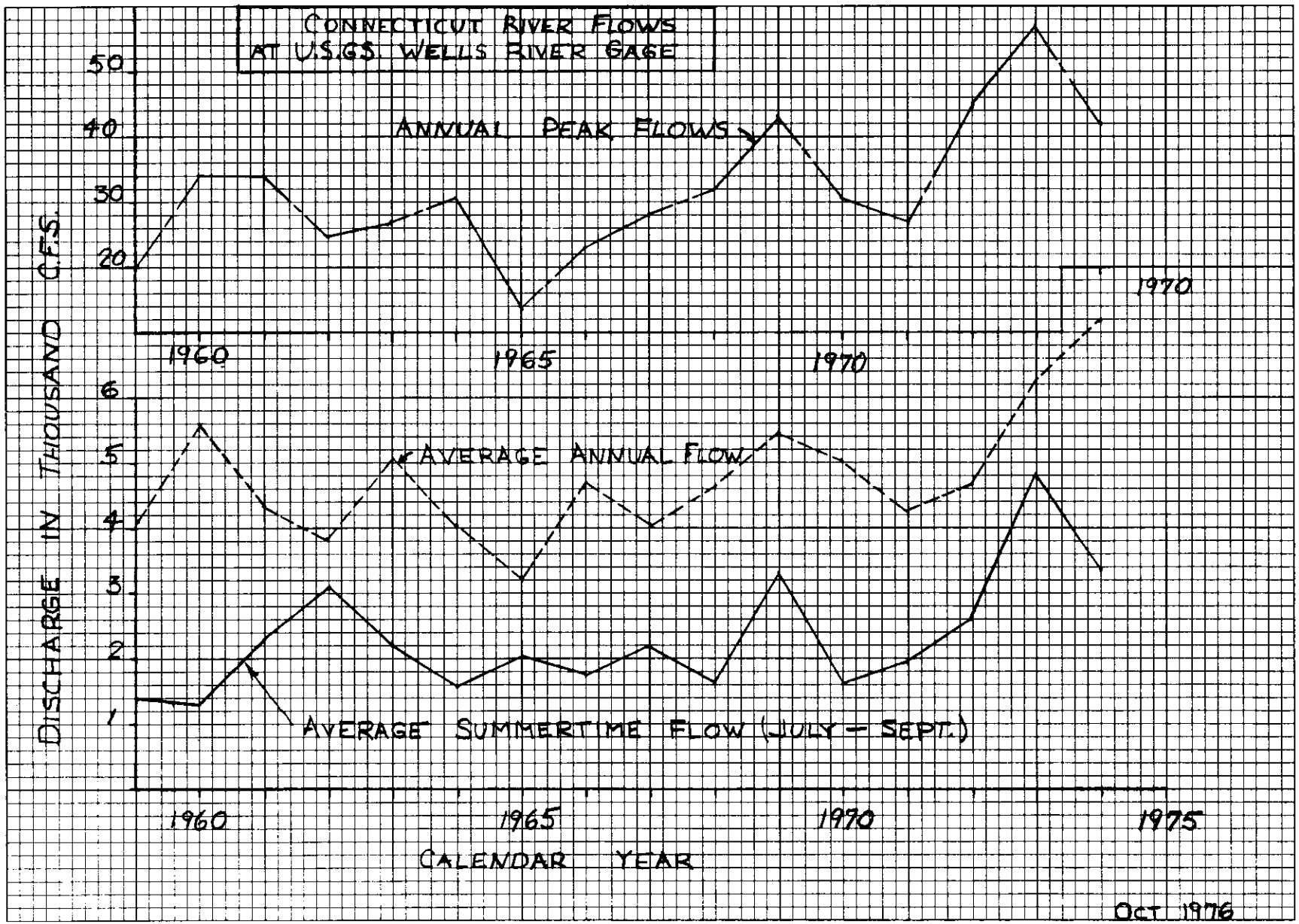

CONNECTICUT RIVER FLOWS
AT U.S.G.S. WELLS RIVER GAGE
ANNUAL PEAK FLOWS
AVERAGE ANNUAL FLOW
AVERAGE SUMMERTIME FLOW (JULY – SEPT.)
DISCHARGE IN THOUSAND C.F.S.
50
40
30
20
6
5
4
3
2
1
1960
1965
1970
1975
1970
CALENDAR YEAR
OCT 1976

PLATE NO. 4

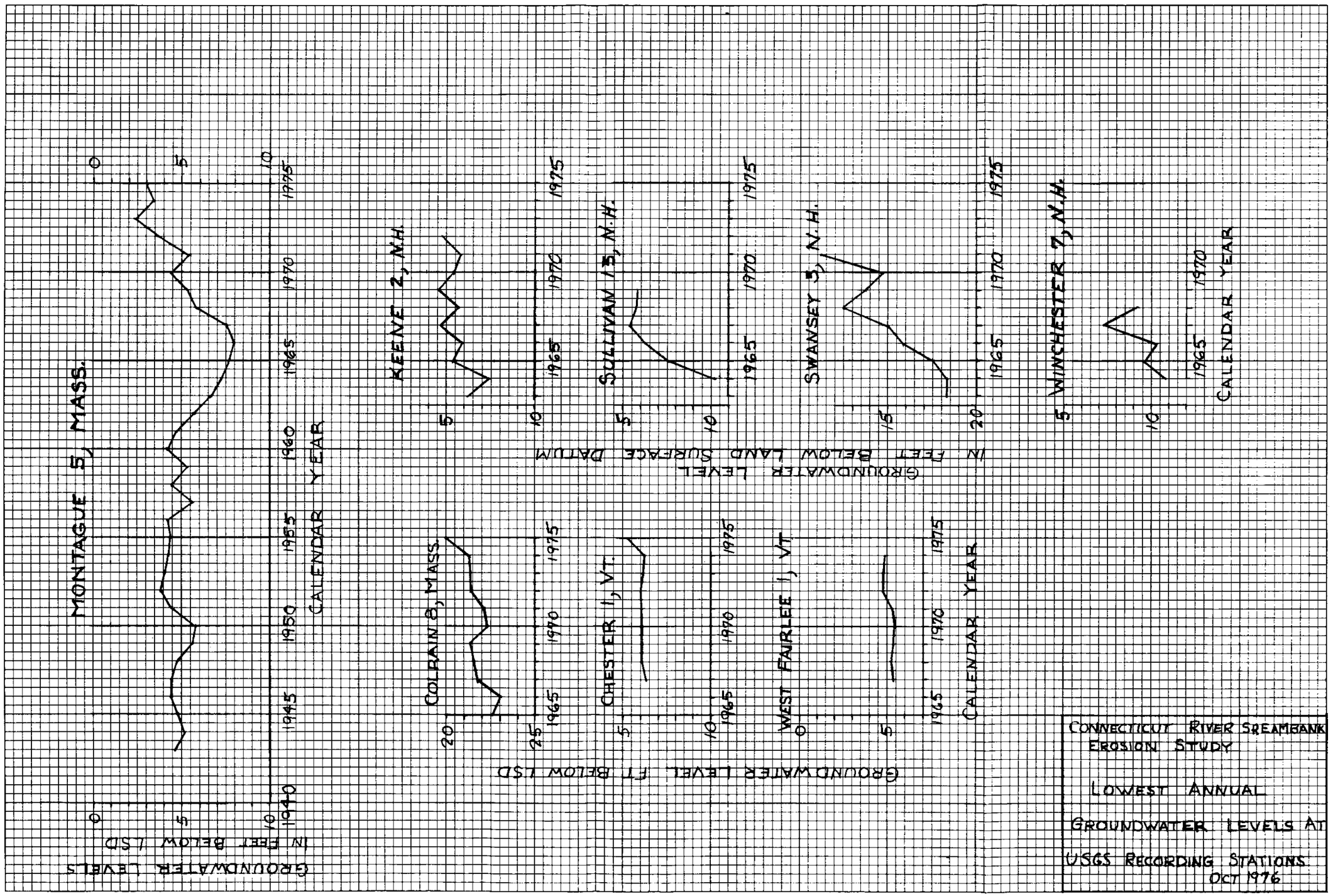

MONTAGUE
CALENDAR YEAR
1940
1945
1950
1955
1960
1965
1970
1975
0
5
10
IN FEET BELOW LSD
GROUNDWATER LEVELS
COLRAIN 8, MASS.
CHESTER 1, VT.
WEST FAIRLEE 1, VT
GROUNDWATER LEVEL FT BELOW LSD
KEENE 2, N.H.
SULLIVAN 15, N.H.
SWANSEY 3, N.H.
WINCHESTER 7, N.H.
GROUNDWATER LEVEL
IN FEET BELOW LAND SURFACE DATUM
CALENDAR YEAR
CONNECTICUT RIVER STREAMBANK EROSION STUDY
LOWEST ANNUAL GROUNDWATER LEVELS AT USGS RECORDING STATIONS
OCT 1976

PLATE NO. 5

TABLE 4

WILDER DAM
AVERAGE WEEKDAY POOL FLUCTUATIONS
(feet)

	1952-1954	1957-1959	1962-1964	1972-1974
July	0.8	1.1	1.1	1.8
December	1.3	1.2	1.6	1.8

This is better explained in 19 July 77 Ltr. to Lyman Allen.

shows that the pool fluctuations have increased in recent years by an average of 0.2 to 0.7 foot over the fluctuations of the 1950's and 1960's. However, it should be noted that daily power releases are made so the pool can be refilled at night and on weekends. The peak release rate is limited to 9,700 cfs by the capacity of the turbines and the volume of release is limited by the natural inflows. Therefore, it can be concluded that although the pool has fluctuated to a greater degree in recent years, it has resulted from higher natural streamflows and not a change in the Wilder Dam operation procedure.

Aerial photographs taken in 1939, 1971 and 1973 along the Wilder Pool indicate that the present and past erosion of streambanks were equally severe. However, no measurements of the extent of bank erosion were made during the 1950's and 1960's to compare with the data recorded by the Soils Conservation Service or the Corps of Engineers since 1973.

If the erosion has been accelerating in recent years, it was due to either natural streamflow and groundwater conditions or wave action of increased power boat activity but not as a result of a more severe operation of Wilder Dam.

E. GEOTECHNICAL ANALYSIS

1. General - The "Geotechnical Analysis", presents by topics, the various investigations which are being performed by the Foundations and Materials Branch. The following describe the work done and what has been achieved or attempted by the study.

2. Aerial Interpretation in Determining Erosion - The Foundations and Materials Branch began its part of the study using aerial photographs and existing reports in an attempt to pinpoint the locations of major erosion. The result of this attempt follows:

The aerial photographs used were taken in 1939, 1965, 1971, and 1973. The 1939 photographs were of the entire reach from Turners Falls Dam to Haverhill, New Hampshire. The 1965 photographs were taken between the Turners Falls Dam and the Vernon Dam. The 1971 and 1973 photographs were taken during high water conditions between Hanover, New Hampshire and Haverhill, New Hampshire. All these aerial photographs were taken from a high altitude resulting in photo scales between 1"=3,333' to 1"=2,000'.

Sixteen candidate areas were chosen using an aerial photography interpretation method. Of the six final study areas, three were chosen from the candidate areas. These study areas are located between the Vernon Dam and the Wilder Dam where only the 1939 photographs were available. Though only three of the areas were chosen using this method, aerial interpretation has proven to be a very useful tool in this study. Most of the candidate areas proved to be locations of erosion, though not always significant. Only a few of the areas had no erosion problems or bedrock at their banks. The reason for this misinterpretation was that the aerial photographs were taken from such a high altitude that details that would distinguish raw banks from bedrock banks were minimal. Furthermore, most of the major erosion areas had slopes near to the vertical allowing the erosion to go undetected in the photographs taken from such high altitudes. Therefore, greater success would have been experienced if the photographs were taken from a lower altitude, between 500 to 1000 feet above the river level.

Another reason for the limited success is that the 1939 and 1965 photographs were taken before the Turners Falls Dam and the Wilder Dam were raised. The shorelines examined in these photographs no longer exist. Also, the 1971 and 1973 aerial photographs, used for comparison with the 1939 photographs were taken during spring high flows when there was overtopping of the shoreline to be inspected. Thus, for better results photographs to determine erosion should be taken during low-flow periods, preferably in the early spring or fall when little vegetation exists.

In conclusion, comparison of aerial photographs is very useful in giving the various landforms, land uses, old oxbows, and insight into the former behavior of the river which could help predict the future changes in the river's flow.

3. Soils Exploration - Borings behind the edge of the banks and test pits along the raw banks (see Appendix A for topographical maps giving their locations) have been completed at all the areas. Preliminary analyses of test results (see appendix) from these completed boring and test pits are complete. It was found that all bank materials in the study areas were water-laid deposits composed mostly of silty, fine sands (SM) and non-plastic fine, sandy silts (ML). There were also pockets of silty sandy gravels (GP-GM) and sandy silty clays (CL) found at various areas. Banks made up of such fine grain materials are very susceptible to erosion when not covered by vegetation.

4. Groundwater Study - Two piezometers were installed at area 51 after the borings were made. These will be used in an attempt to relate the groundwater table to the pool fluctuation.

5. Periodic Inspections - Periodic inspections of each study area are scheduled throughout the study. Each inspection consists of observing changes since the last inspection and taking color prints at referenced points in order to keep track of the erosion. To date, these photographs have shown signs of definite erosion.

During one of the periodic inspections in the spring when thawing was occurring it was observed that the fines were flowing out of the raw banks with the water from the thawing ice inside and above the bank.

This resulted in leaving an erodible section susceptible to the coming spring high flows. This phenomenon is definitely one of the causes of the erosion, but what percentage it plays in the total erosion is impossible to determine.

6. Periodic Surveys and Cross-Sections - A survey program, consisting of a plane table survey with ground and river bottom elevations taken along the streambank and at station intervals spaced 100 feet apart perpendicular to an established base line has been set up to provide periodic data in the fall and spring. With the information obtained from these preliminary surveys, cross-sections were developed to show the loss or gain of material (see Appendix A for typical cross-sections).

To date, all the areas have been surveyed at least once. Three of the areas, Areas 147, 31 and 26, have had the preliminary cross-sections drawn up with the subsequent spring cross-sections drawn over. They indicate both the removal and the deposition of material during the six month duration between surveys. The remaining three areas have been surveyed this spring with the other areas. Their preliminary cross-sections are in the process of being drawn and will be available for comparative evaluation with the next survey to be taken in the fall.

Using the drawn cross-sections and the information from the borings, an attempt will be made to correlate the soil type to the amount of erosion.

7. Other Geotechnical Work - The "Geology" section of the "Geotechnical Section" is being completed for use in the final report. This will include a general history of how the area was formed, the pertinent geology of the area, and specific soils information, including test data on the study areas.

F. FUTURE OF THE STUDY

Hydraulics and soils studies will continue so that the firmest possible conclusions can be drawn regarding the causes of erosion. Surveillance of the index study areas will continue through 1977 and 1978 to provide evidence regarding the relative effect of the various causative factors. It is felt that findings developed for the pilot areas can be extrapolated to other streambank reaches within the study area.

If rapid pool drawdown proves to be a significant factor, then the practicality of stabilizing the power pools will be considered. The costs and benefits of stabilizing pool levels will be compared. All four hydroelectric pools are licensed by the Federal Power Commission. It will be the FPC's responsibility to review the study report and determine if an operational change is in order. The FPC would hold public meetings on the subject and if in its judgment, operational changes are in order, these changes would be recommended to the power companies. The FPC has the authority to insist upon operational changes of this nature.

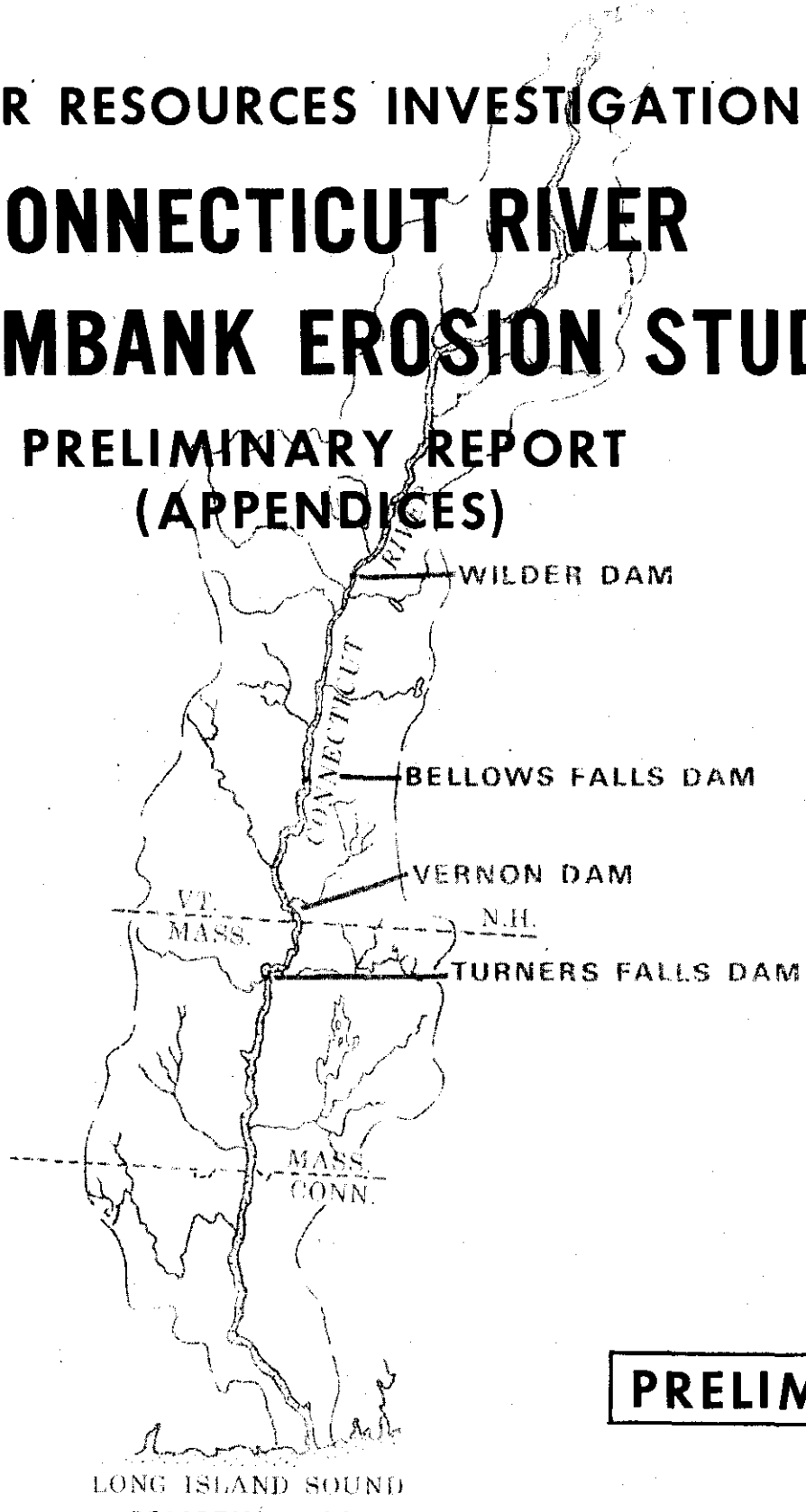
The study is not expected to lead to any Federal streambank revetment projects. Most of the bank is in private ownership and the government generally has not assumed the responsibility of constructing protective works to alleviate streambank erosion problems on private property. There are several localized situations where secondary public roads may be threatened; however, these problem areas are small and corrective work would be within the scope of Section 14 of the 1946 Flood Control Act, as amended.

A public hearing is scheduled early in 1978, however, it is felt that an interim and less formal workshop session would be constructive, after this preliminary report has been distributed and reviewed. A workshop session is therefore tentatively planned for the early spring of 1977. The study completion date remains, as originally scheduled, in June of 1978.

WATER RESOURCES INVESTIGATION

CONNECTICUT RIVER STREAMBANK EROSION STUDY

PRELIMINARY REPORT (APPENDICES)



PRELIMINARY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

DECEMBER 1976

APPENDIX A

APPENDIX A

DATA PRESENTATION

Most of the study effort to date has gone into data collection and interpretation. The interpreted data is the basis for the preliminary report, its tables and graphs. Some data has been collected and will await future data so that certain comparisons can be made.

Uninterpreted or raw data is not normally carried in a report such as this, however, Appendix A is provided for those readers who would delve deeply into the technical aspects of the study. This Appendix presents raw data most of it as gathered in the field and the laboratory. A rudimentary interpretation of some of the data is also provided.

Soils information includes field logs of test borings and test pits along with sketches, water table and piezometer information. The results of soils laboratory testing on samples of bank material is provided in the form of gradation curves of sieved material and a table of Atterburg Limits and specific gravities.

The main report discusses bank and river bottom field surveys. The survey record or "plane table" sheets of the field work are presented in this Appendix. These survey records provided the information to prepare typical cross-sections which are on the last sheet of this Appendix. These cross-sections were prepared only for the three test areas on which two surveys have been completed.

As the study proceeds, more data will be obtained and all the data will be scrutinized, interpreted and presented in as clear a fashion as possible.

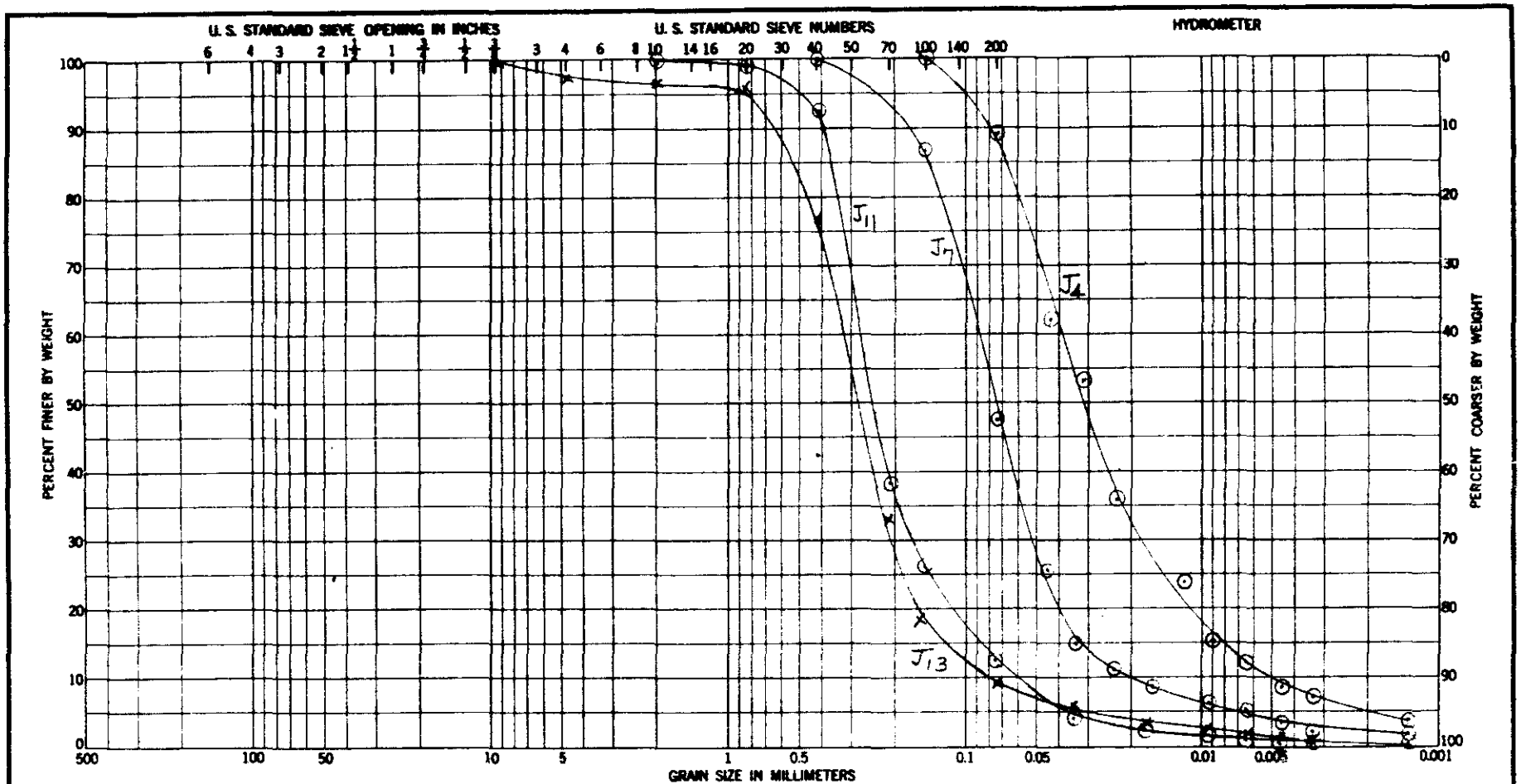
NED FORM 223
27 Sept 49

NEW ENGLAND DIVISION
CORPS OF ENGINEERS, U. S. ARMY

PAGE

SUBJECT Connecticut River Erosion Study
COMPUTATION Atterberg Limits & Specific Gravity Results
COMPUTED BY Adam CHECKED BY DATE 22 Sept 76

Boring No.	Sample No.	Area	G_s	LL	PL	PI
FD-1	J_{10}	26	2.72	NP	NP	NP
FD-1	J_{19}	31	2.72	NP	NP	NP
FD-1	J_{31}	31	2.69	NP	NP	NP
FD-1	J_5	51	2.66	NP	NP	NP
FD-2	J_6	51	2.67	NP	NP	NP
FD-1	J_8	90A	2.71	NP	NP	NP
FD-1	J_{14}	90A	2.75	NP	NP	NP
FD-1	J_4	147	2.68	NP	NP	NP
FD-1	J_7	147	2.71	NP	NP	NP
FD-1	J_{19}	255	2.69	NP	NP	NP
FD-1	J_{24}	255	2.70	39	26	13



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
J-4	5.0'-9.3'	Fine sandy SILT (ML)				
J-7	10.0'-15.0'	silty Fine SAND (SM)				
J-11	20.0'-25.0'	silty Fine SAND (SM)				
J-13	25.0'-27.8'	silty m-F SAND (SP-SM)				

GRADATION CURVES

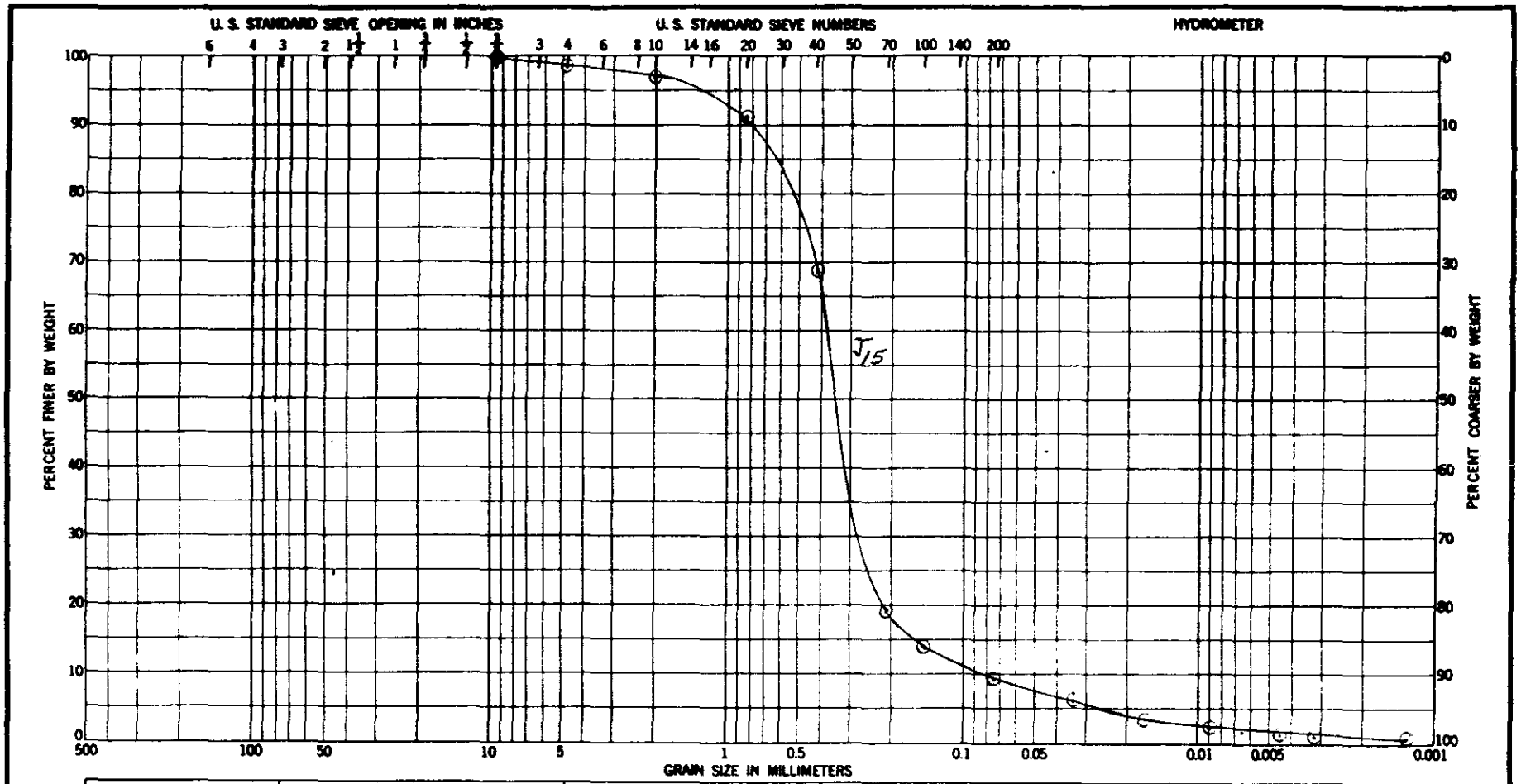
Project: Conn. River Erosion Study

Area: Area # 147

Boring No.: FD-1

Date: August 1976

ENG ( ) FORM AY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
J15	27.8' - 30.0'	silty m-f SAND (SP-SM)				

GRADATION CURVES

Project: Conn. River Erosion Study

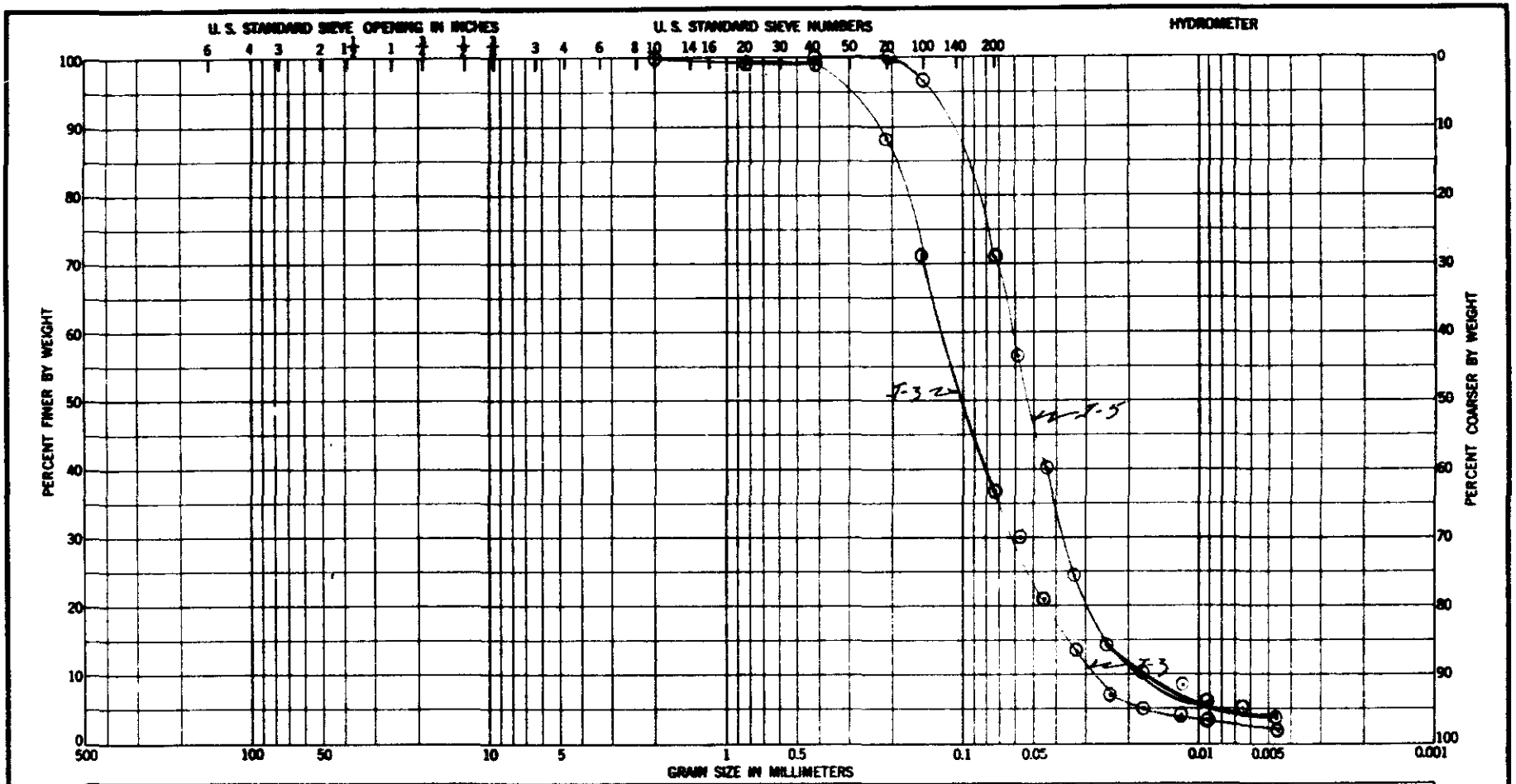
Area: Area II 147

Boring No.: FD-1

Date: August 1976

ENG FORM 1 MAY 63 2087

A-3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
I-3	1.1 - 3.4	Silty fine SAND (SM)				
I-5	3.4 - 4.4	fine Sandy SILT (ML)		NP	NP	NP
		G = 2.66				

GRADATION CURVES

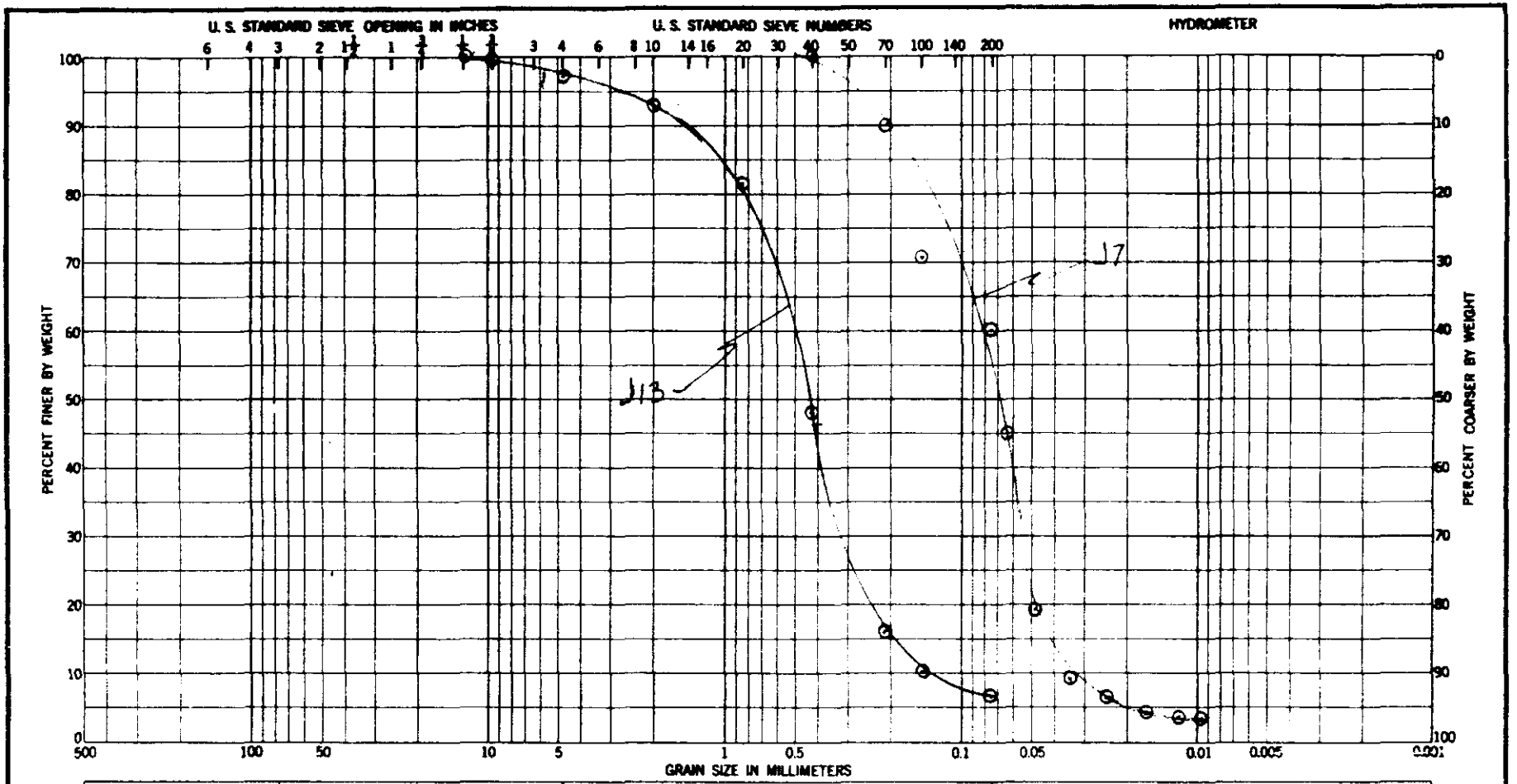
Project Conn. River Erosion Study

Area 51

Boring No. FD-1

Date 9/8/76

ENG(FORM AY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
J 7	5.0' - 10.0'	fine Sandy SILT(ML)				
J13	20.0 - 24.1'	Silty Sand (SP-SM)				

GRADATION CURVES

Project: Conn. River Erosion Study

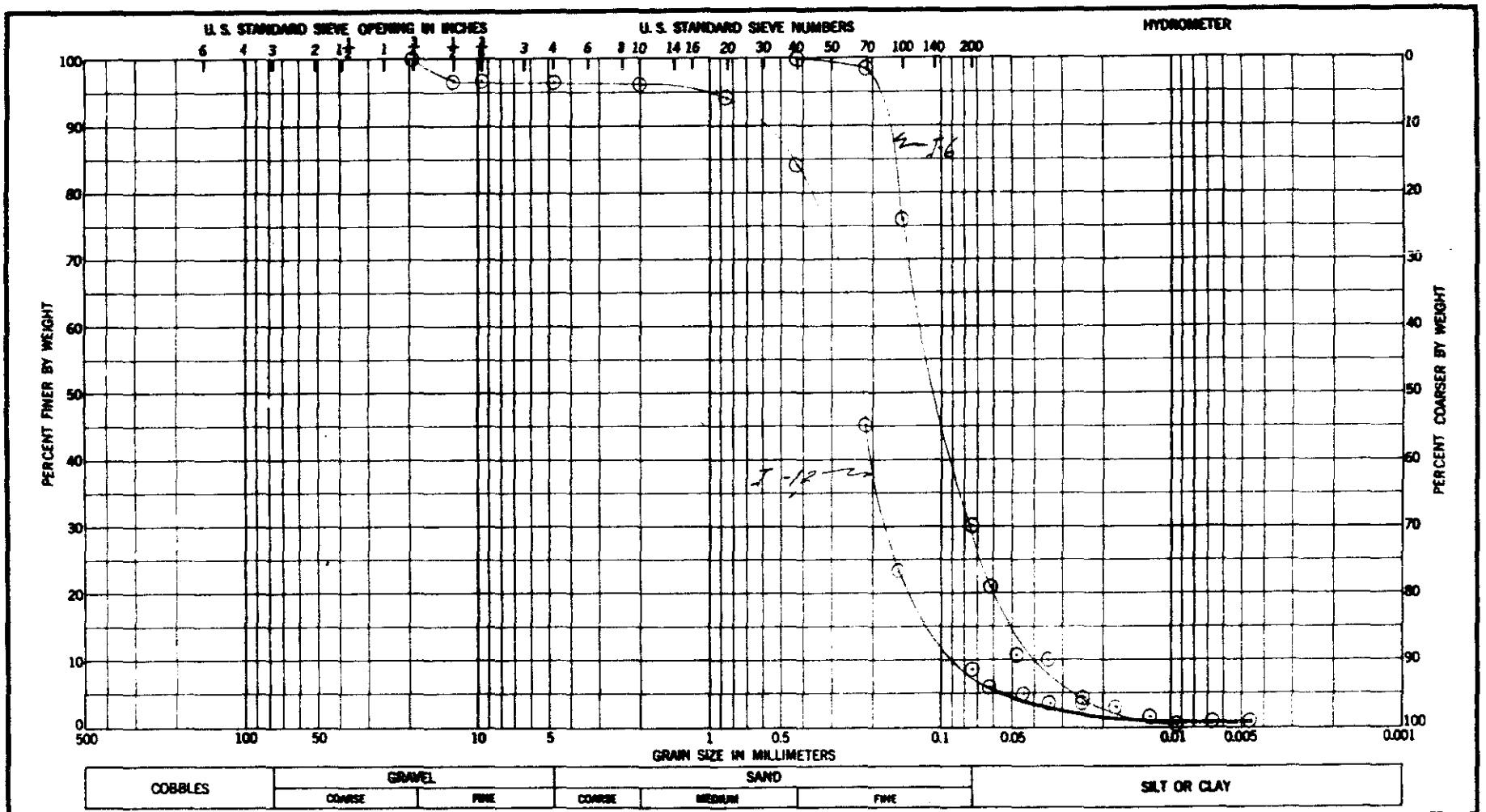
Area: Area #51

Boring No.: ED 1

Date: September 1976

ENG FORM 1 MAY 63 2087

4-5



Sample No.	Elev or Depth	Classification	Nat-w-%	LL	PL	PI
J-6	5.0-10.0	silty fine SAND (SM) G=2.67		NP	NP	NP
J-12	20.0-25.0	silty M-f SAND (SP-SM)				

GRADATION CURVES

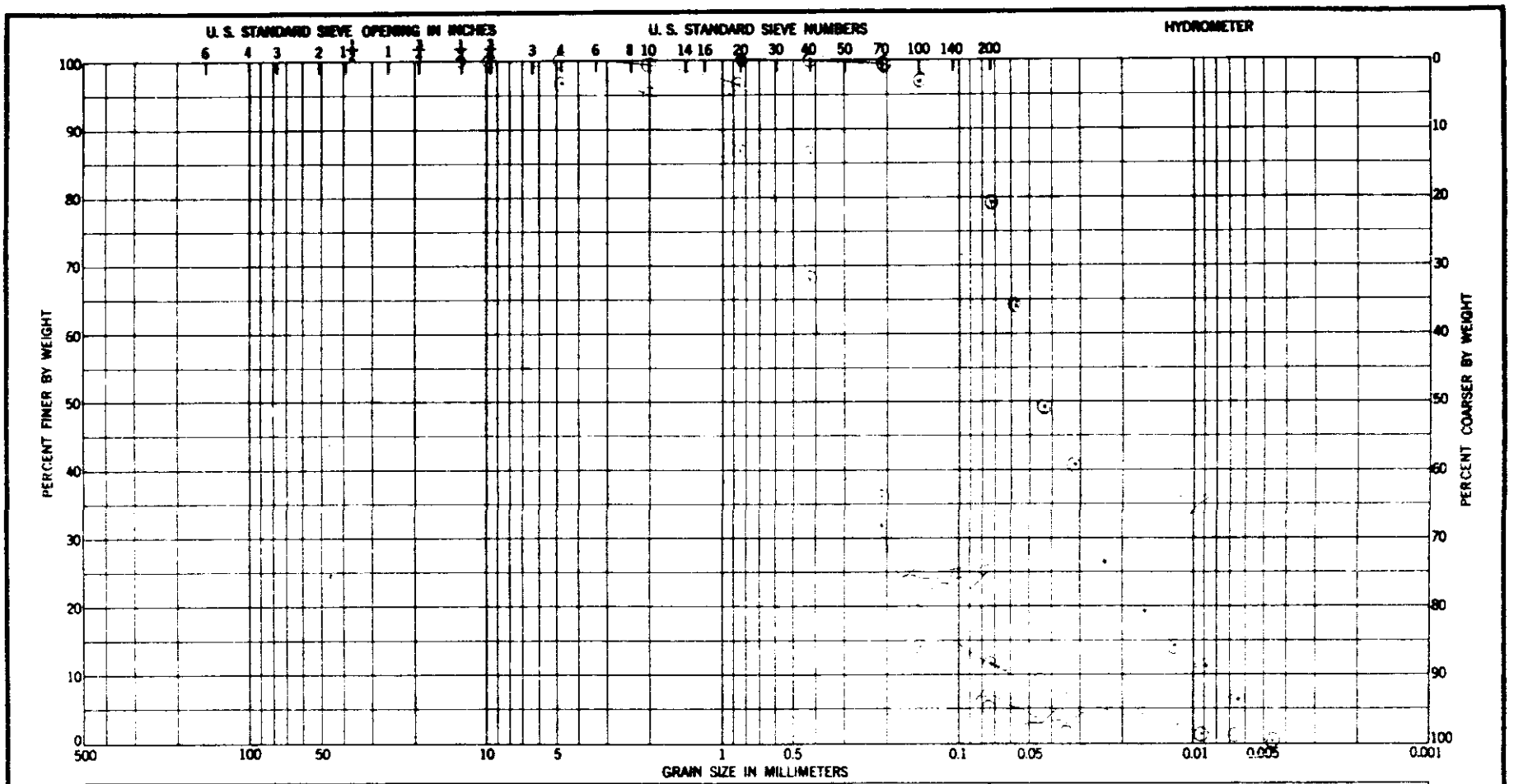
Project Coos River Erosion Study

Area 51

Boring No. FD-2

Date 9/9/76

ENG FORM MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
1						
2						

GRADATION CURVES

Project

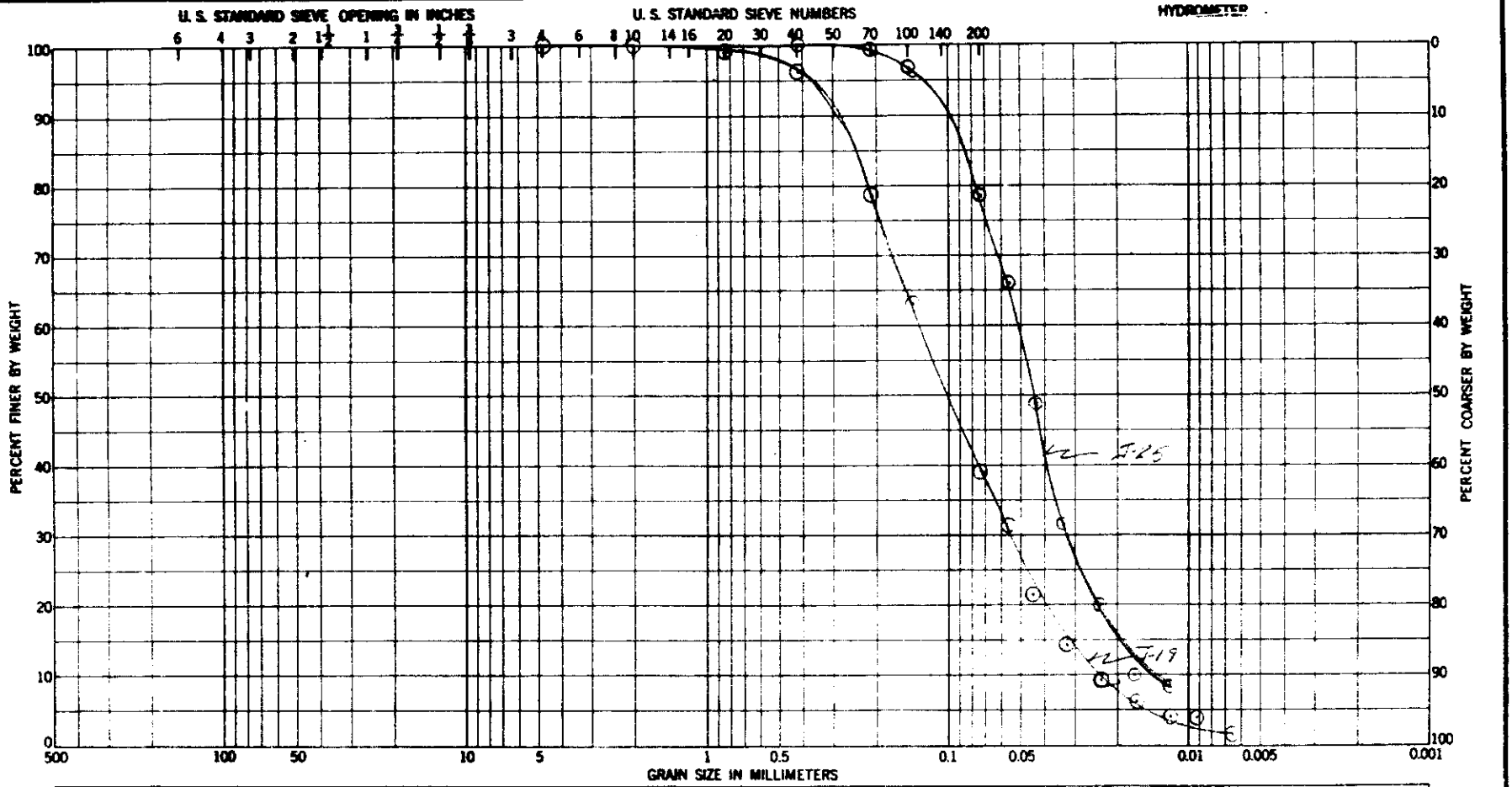
Area

Boring No.

Date

ENG FORM 1 MAY 63 2087

A-7



Sample No.	Elev or Depth	Classification	Nat-w-%	LL	PL	PI
F-19	30.0 to 34.6	Silty Mf Sand (SM)	G = 2.72	NP	NP	NP
F-25	40.0 to 45.0	Fine Sandy SILT (ML)				

GRADATION CURVES

Project: Soils Exploration Study

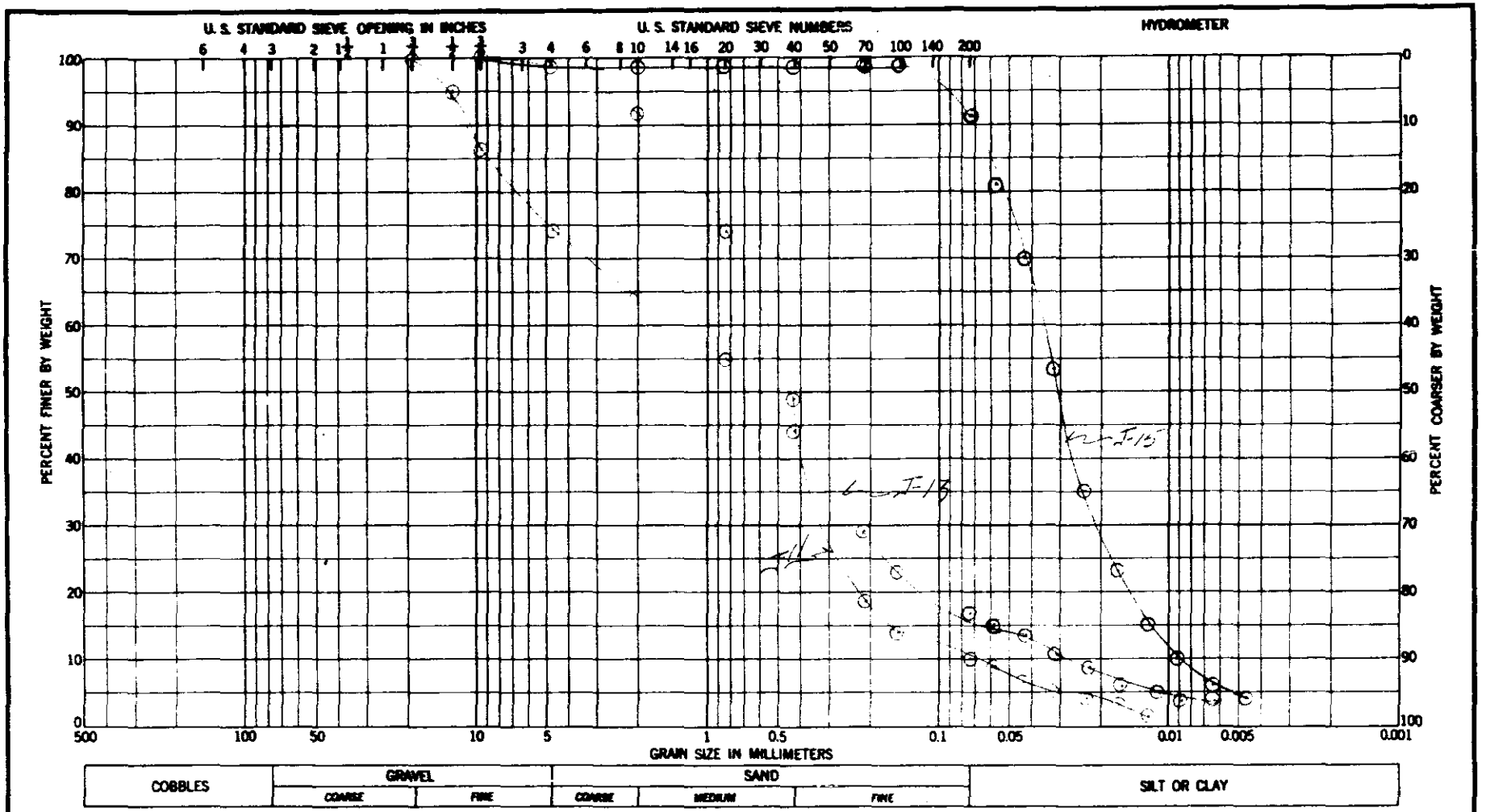
Area: 3/

Boring No.: F-1

Date: 9-7-70

B-4

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
J-15	20.0 to 25.0	Fine Sandy Silt (ML)				

GRADATION CURVES

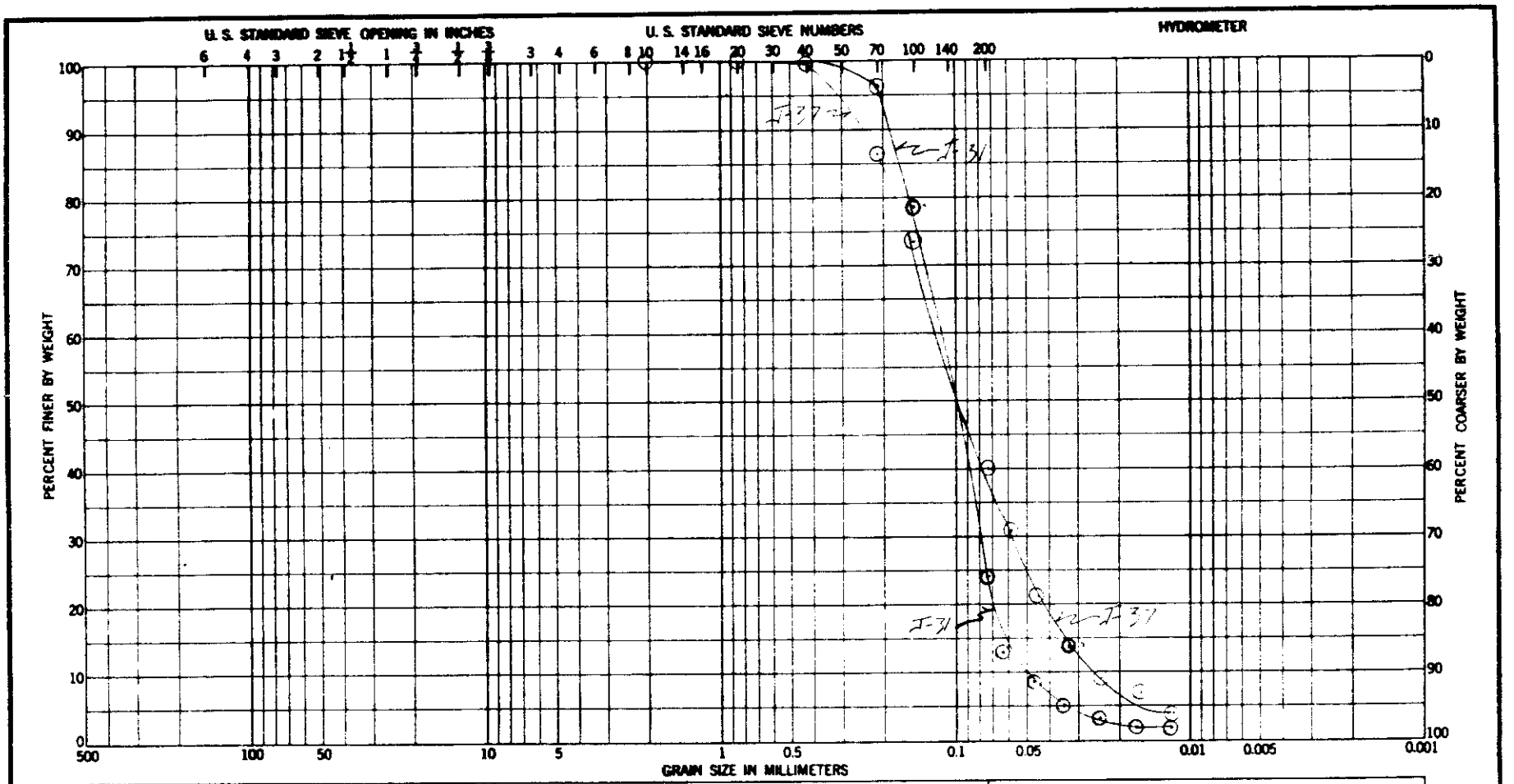
Project

Area

Boring No.

Date 2/2/76

ENG FORM 1 MAY 63 2087



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat.-m.-%	LL	PL	PI
I-31	50.0-55.0	Silty fine SAND (SM)	G=2.69	NP	NP	NP
I-37	65.0-70.0	Silty fine SAND (SM)				

Project Cona. River Erosion Study

Area 31

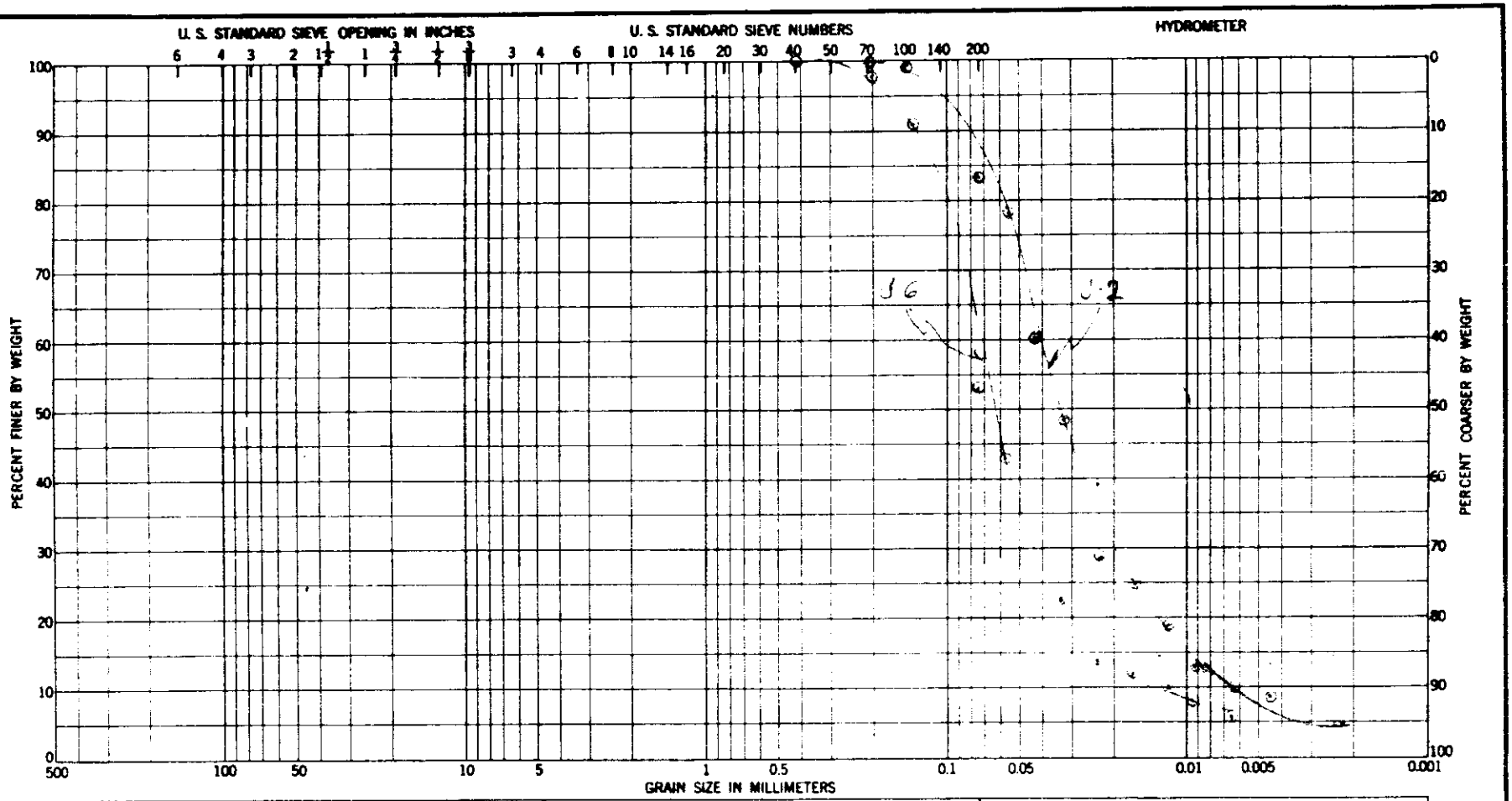
Boring No. Ex-1

Date 7-7-70

GRADATION CURVES

ENG FORM 1 MAY 63 2087

A-10



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
J-2	3.7 to 5.0'	fine Sandy SILT (ML)				
J-6	6.1 to 10.0'	fine Sandy SILT (ML)				

GRADATION CURVES

Project: Conn. River Erosion Study

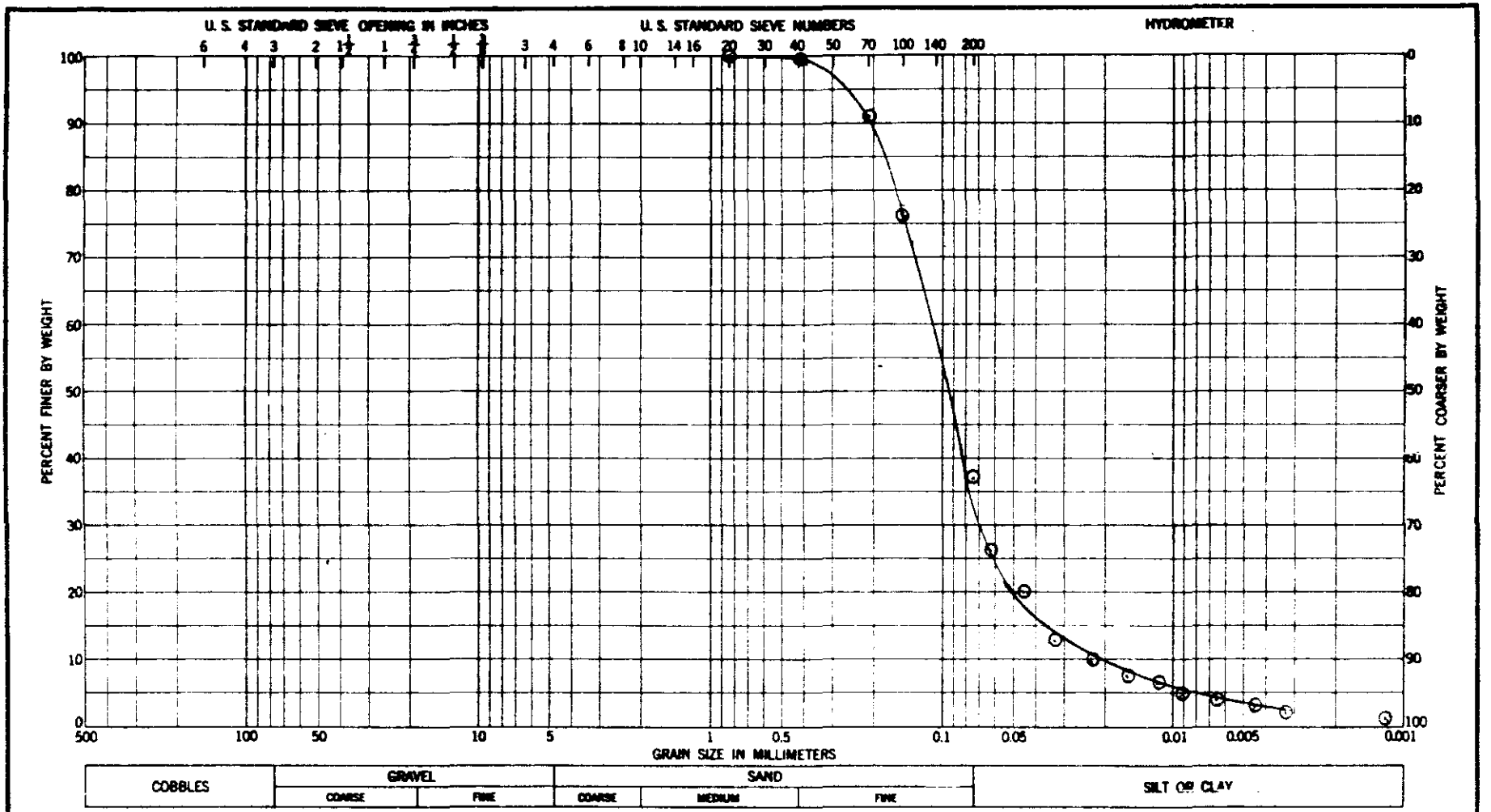
Area: Area #2.6

Boring No.: FD-1

Date: September 1976

ENG FORM 1 MAY 63 2087

11-4



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
J10	15.0'- 20.0'	Silty fine SAND (SM) G = 2.72		NP	NP	NP

GRADATION CURVES

Project: Conn. River Erosion Study

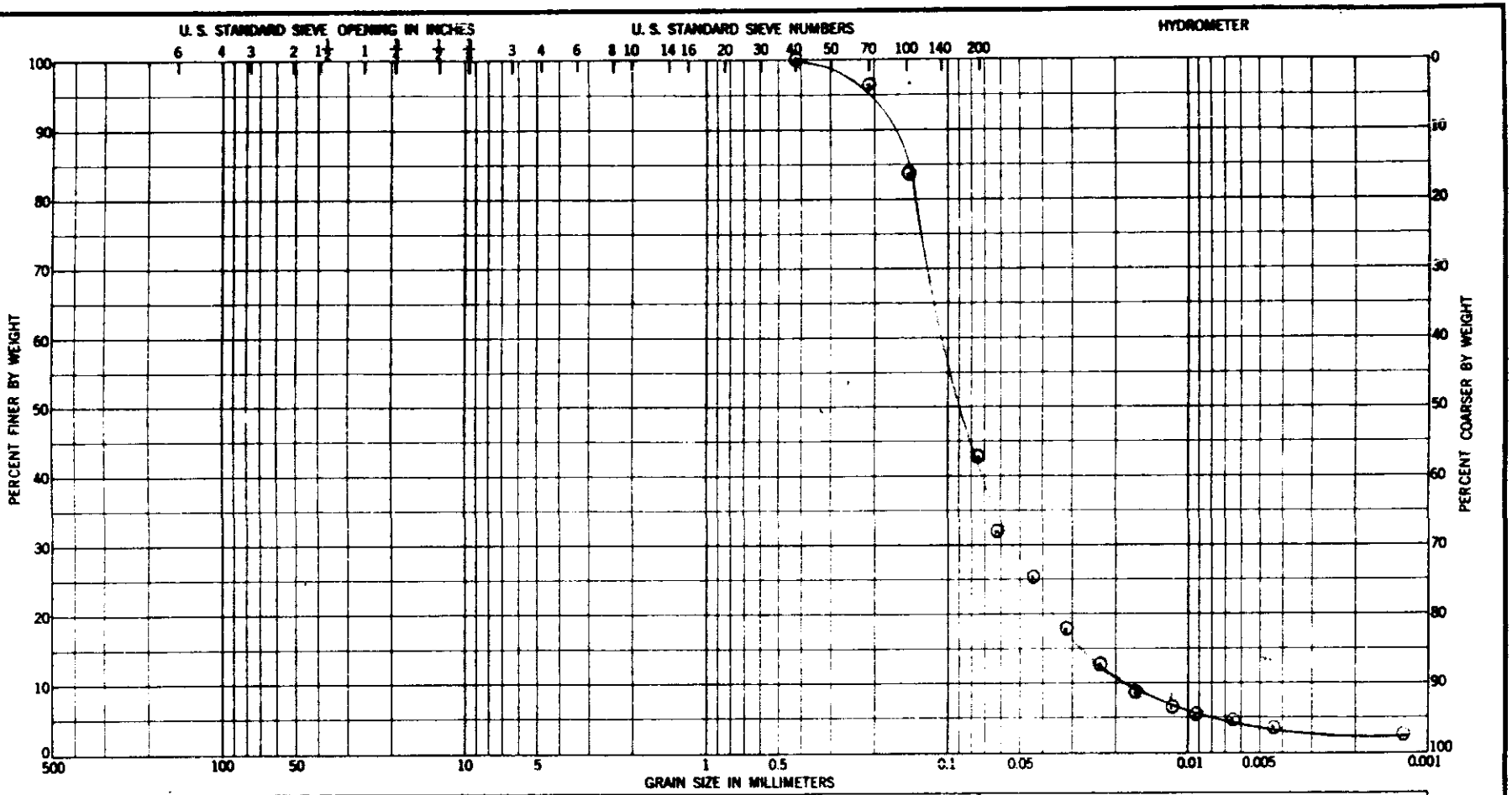
Area: Area #26

Boring No.: FD-1

Date: September 1976

ENG FORM 1 MAY 63 2087

A-12



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
J-12	20.0'-25.0'	Silty fine Sand (SM)				

GRADATION CURVES

Project: Conn. River Erosion Study

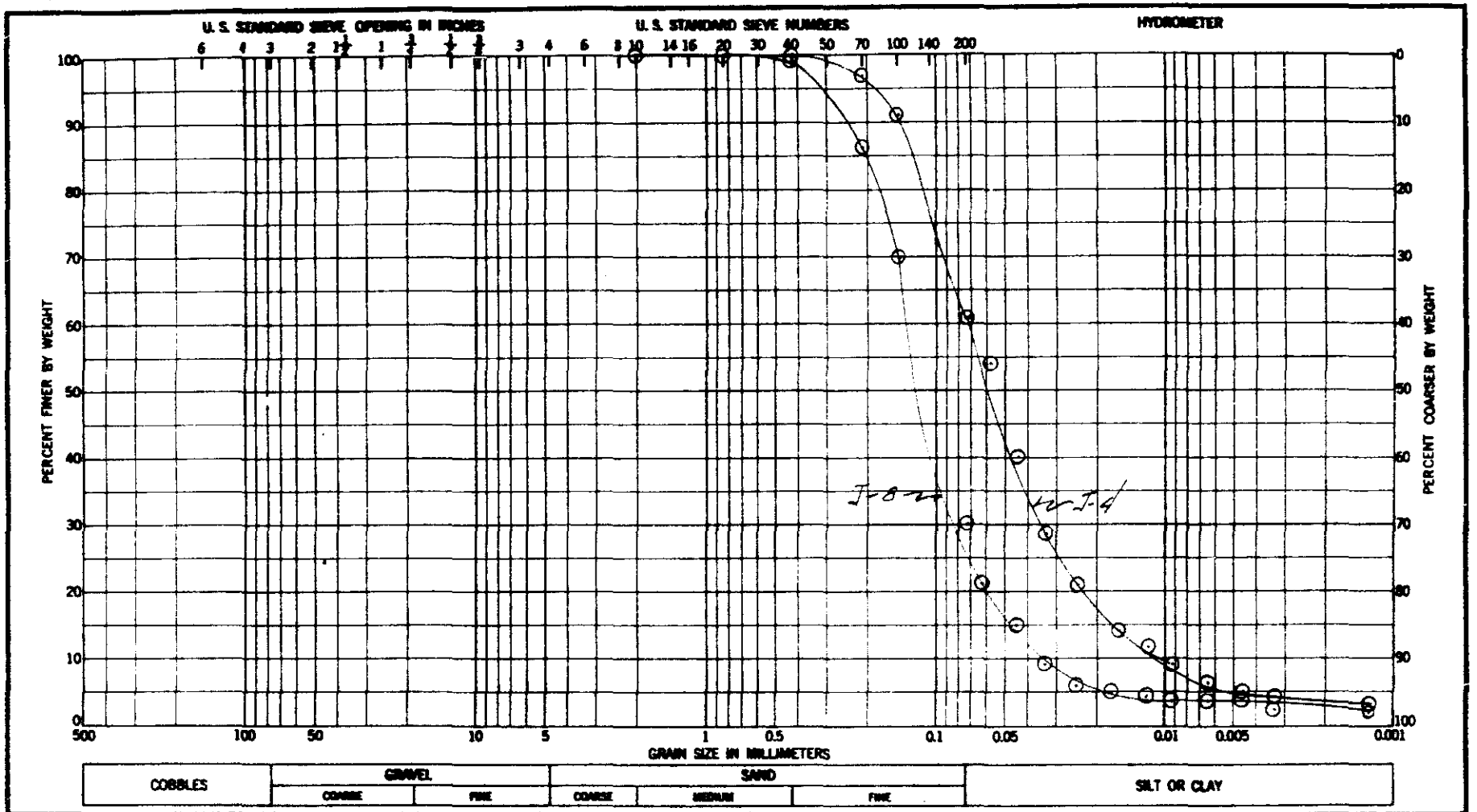
Area: Area #26

Boring No.: FD-1

Date: September 1976

ENG FORM 1 MAY 63 2087

H-13



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
I-4	5.0 to 9.1	Fine Sandy SILT (ML)				
I-8	10.0 to 15.0	Silty Fine SAND (SM) G = 2.71		NP	NP	NP

GRADATION CURVES

Project Cana River Erosion Study

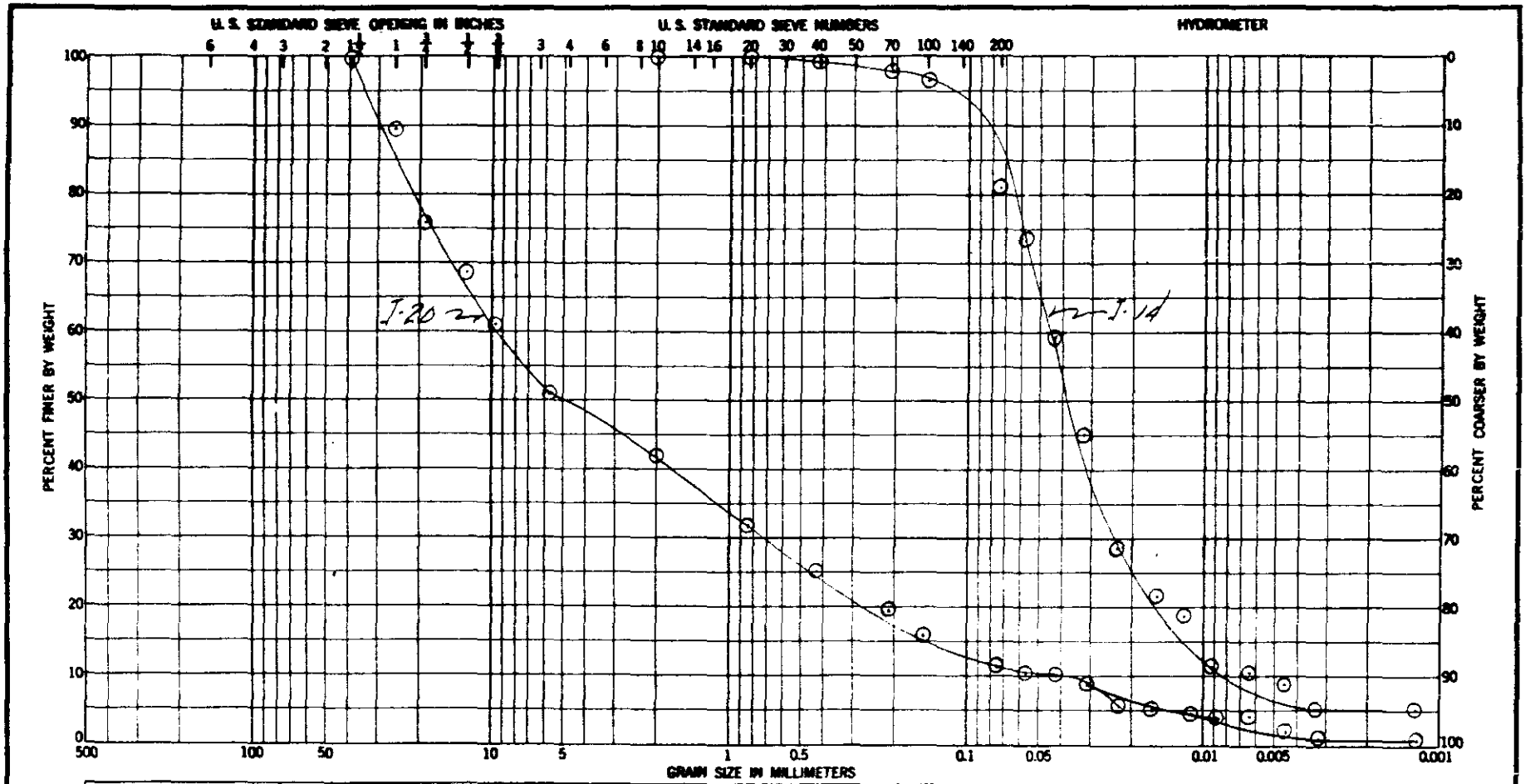
Area 10 A 301

Boring No. FD-1

Date 9/8/76

41-H

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
J-14	20.0 to 22.7	Fine Sandy SILT (ML) G=	2.75	NP	NP	NP
J-20	30.0 to 33.3	Silty Sandy GRAVEL (GP-GM)				

GRADATION CURVES

Project Coon River Ecosys Study

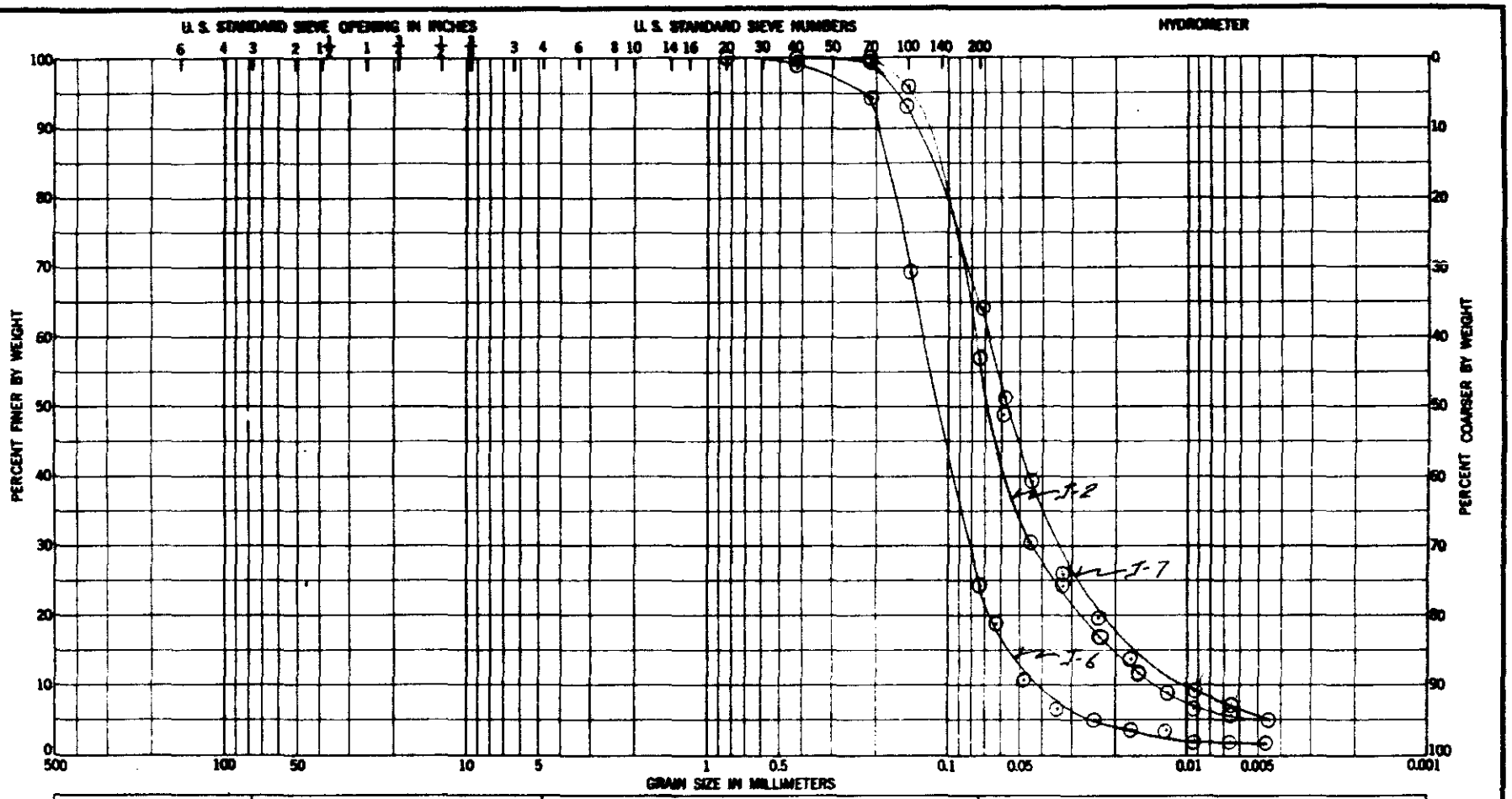
Area 20-A

Boring No. FD-1

Date 9/8/76

S1-4

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
I-2	0.6 - 4.1	Fine sandy SILT (ML)				
I-6	5.0 - 5.6	Silty fine SAND (SM)				
I-7	5.6 - 9.3	fine Sandy SILT (ML)				

GRADATION CURVES

Project: Conn. River Erosion study

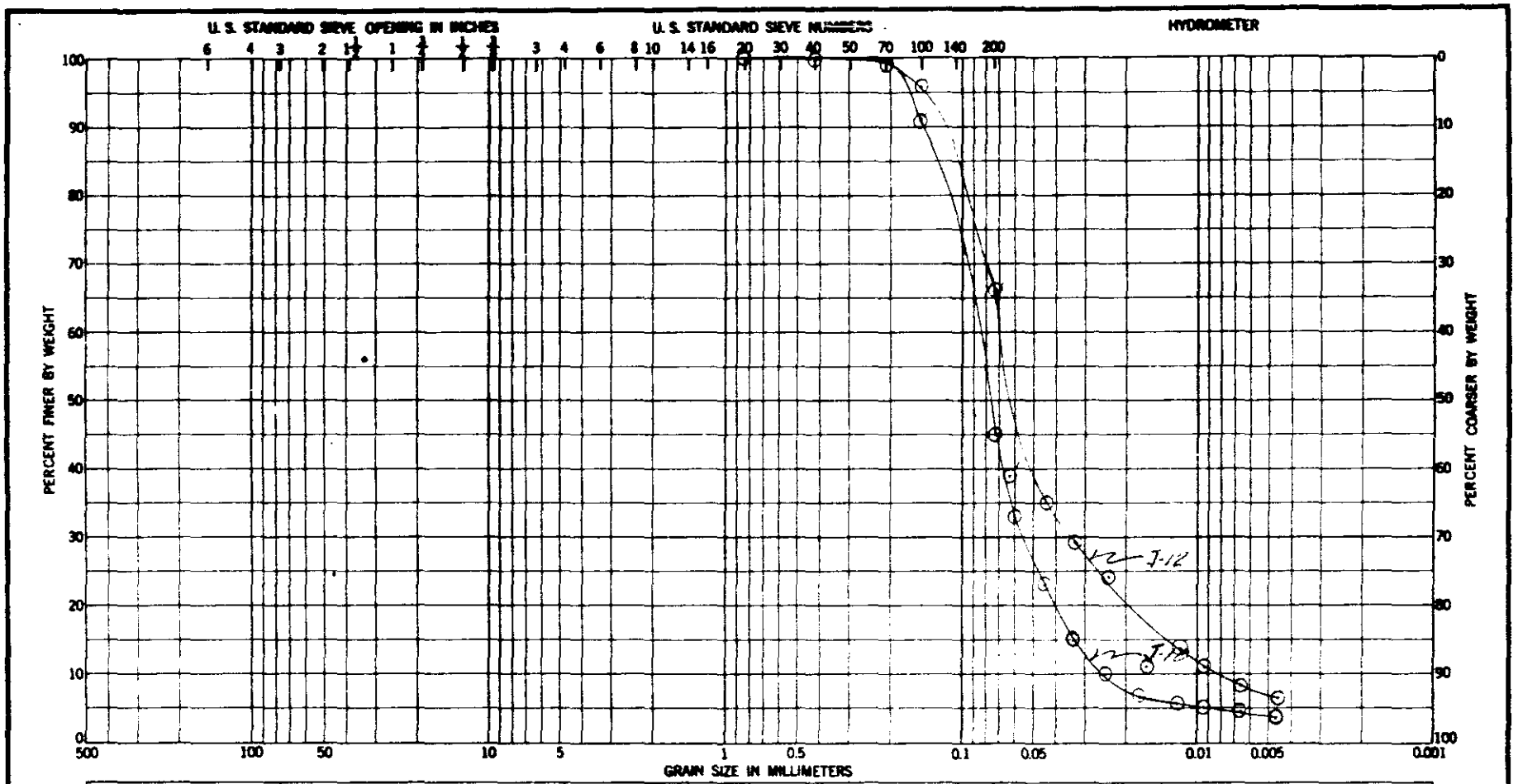
Area: 255

Boring No.: ED-1

Date: 3/8/76

ENG FORM 1 MAY 63 2087

H-14



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
I-10	10.0-12.4	Silty Fine SAND (SM)				
I-12	12.7-13.4	Fine Sandy SILT (ML)				

GRADATION CURVES

Project Coos River Erosion Study

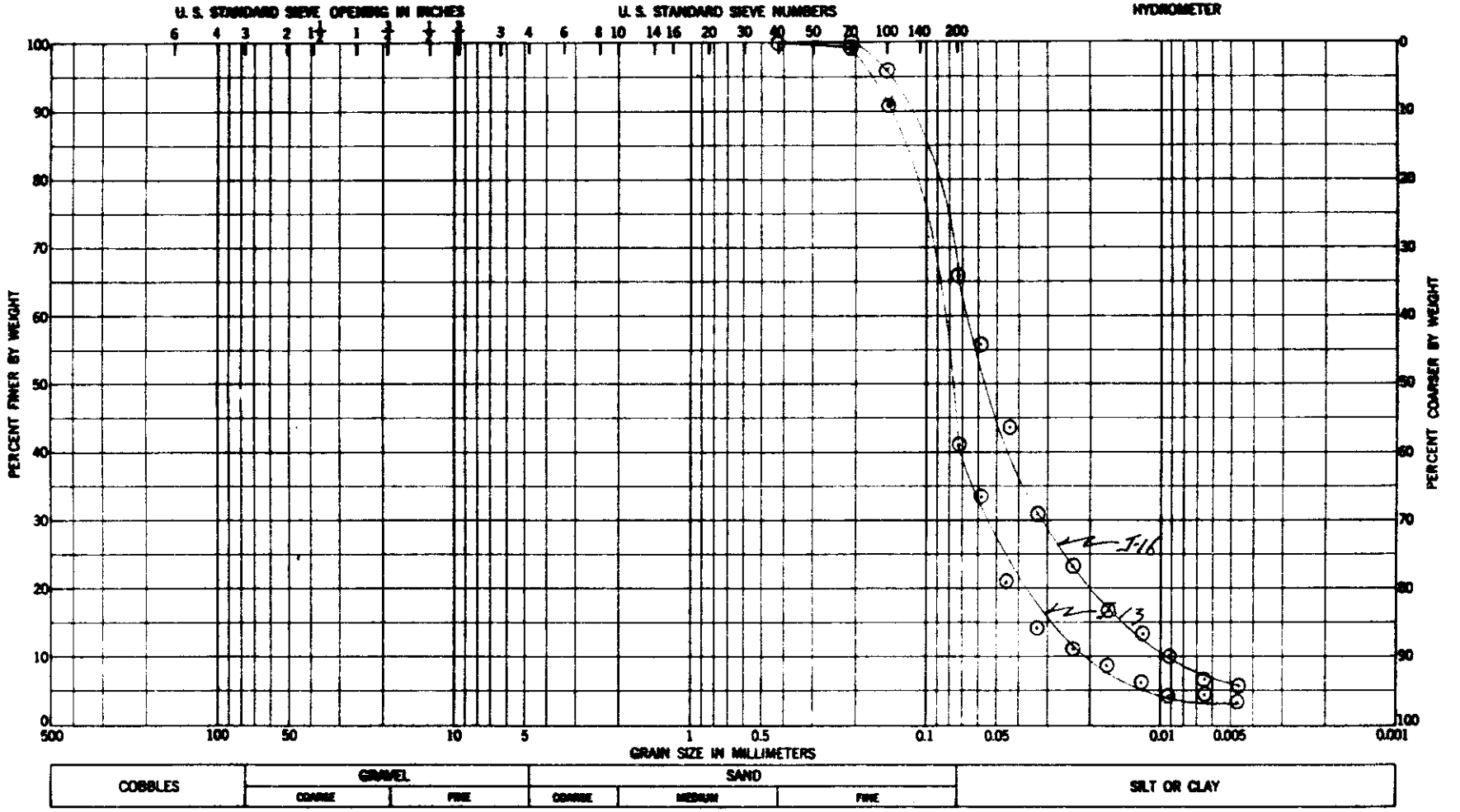
Area 255

Boring No. E-1

Date 7/5/2C

A-17

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
I-13	13.4 - 15.0	Silty fine SAND (SM)				
I-16	18.6 - 19.8	fine Sandy SILT (ML)				

GRADATION CURVES

Project Cook River Erosion Study

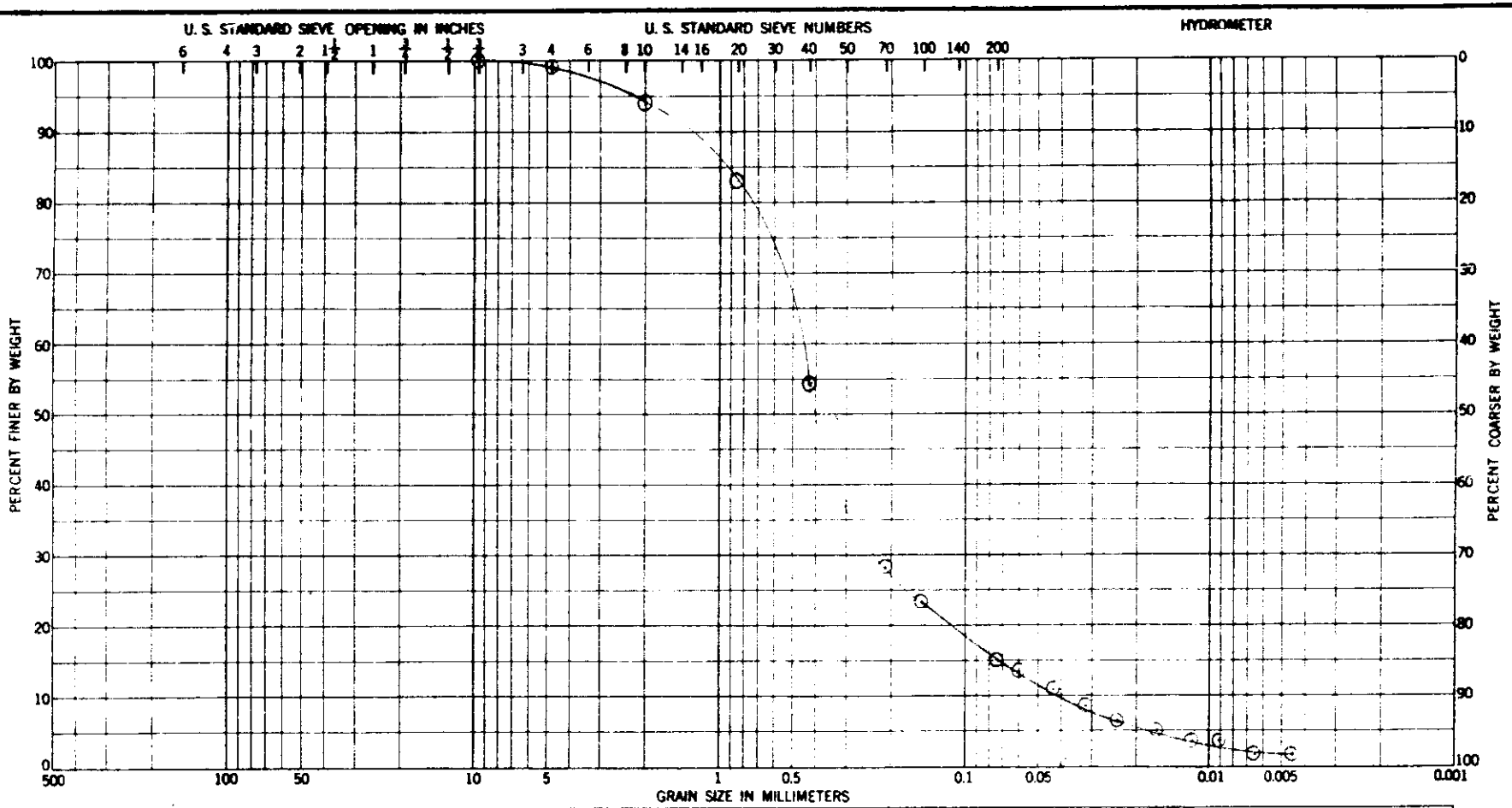
Area 255

Boring No. FD-1

Date 9/8/76

81-4

ENG FORM 1 MAY 62 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
T-19	20.0-21.3	Silty SAND (SM) G = 2.69		NP	NP	NP

Project: Conn. River Erosion Study

Area:

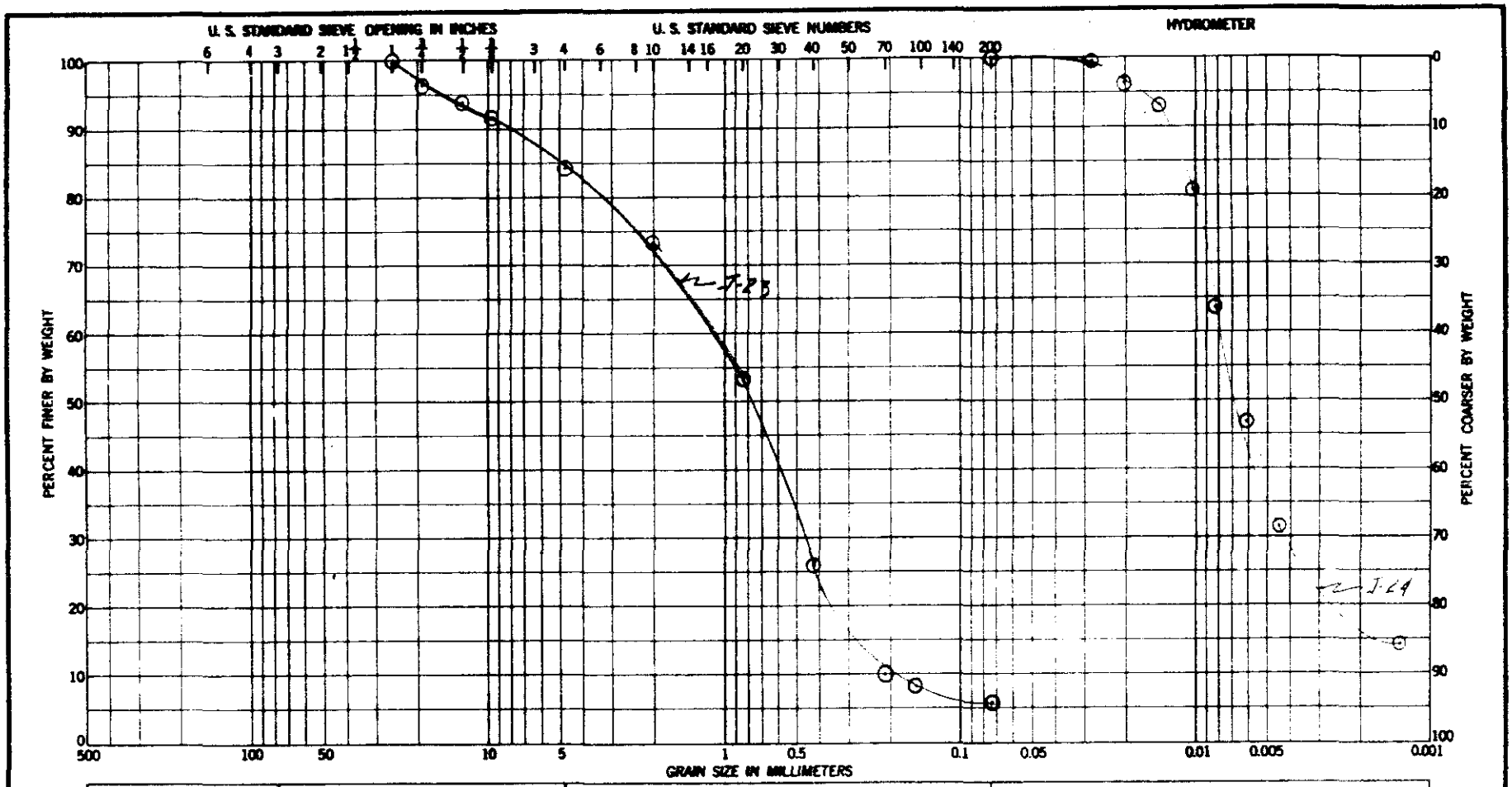
Boring No.: T-19

Date:

GRADATION CURVES

ENG FORM 1 MAY 63 2087

A-19



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
J-23	25.0-28.8	Silty Gravelly SAND (SP-SM)				
J-24	28.8-30.0	SILT (ML) G = 2.70		39.2	26.2	13.0

Project Cona River Erosion Study

Area 255

Boring No. FD-1

Date 9/8/70

GRADATION CURVES

ENG FORM 1 MAY 63 2087

A-20

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

STH 1-66 33 ST

SITE NO. 51 FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

Connecticut River Bank Erosion Studies

SITE Hinsdale NH TYPE EXPLORATION Test Trench DATE 5-67

EXPLORATION NO. T-1 CO-ORD. N _____ E _____ GROUND ELEV. _____

PURPOSE OF EXPLORATION To determine Top of rock in bank erosion

DEPTH 1" = 2.0'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.1	T-1	0.0-0.1		topsoil, grass & roots	Dug w/ Hand Shovel & Pick Hyd Trackhoe from 0.0 To 7.0' unable to Trench Slope below 7.0 due To River Level @ 7.0'
	T-2	0.1 To 2.0		Tan fine Sandy Silt (ML)	
2.0	2 of 2			w/ Lt Dark Brown Sand Strata.	
	1 of 3 R				
7.0		5.5		moist	
5.5					
6.0	T-4 2 of 2	5.5 To 7.0		Brown Fine Sandy Silt (ML)	
7.0	T-5 R				
	Bottom of Exploration @ 7.0' (River Level)				

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-18" Diam. No. _____ Vol. _____ Cu. Ft.
Over 18" No. _____ Vol. _____ Cu. Ft.

WATER TABLE DEPTH _____

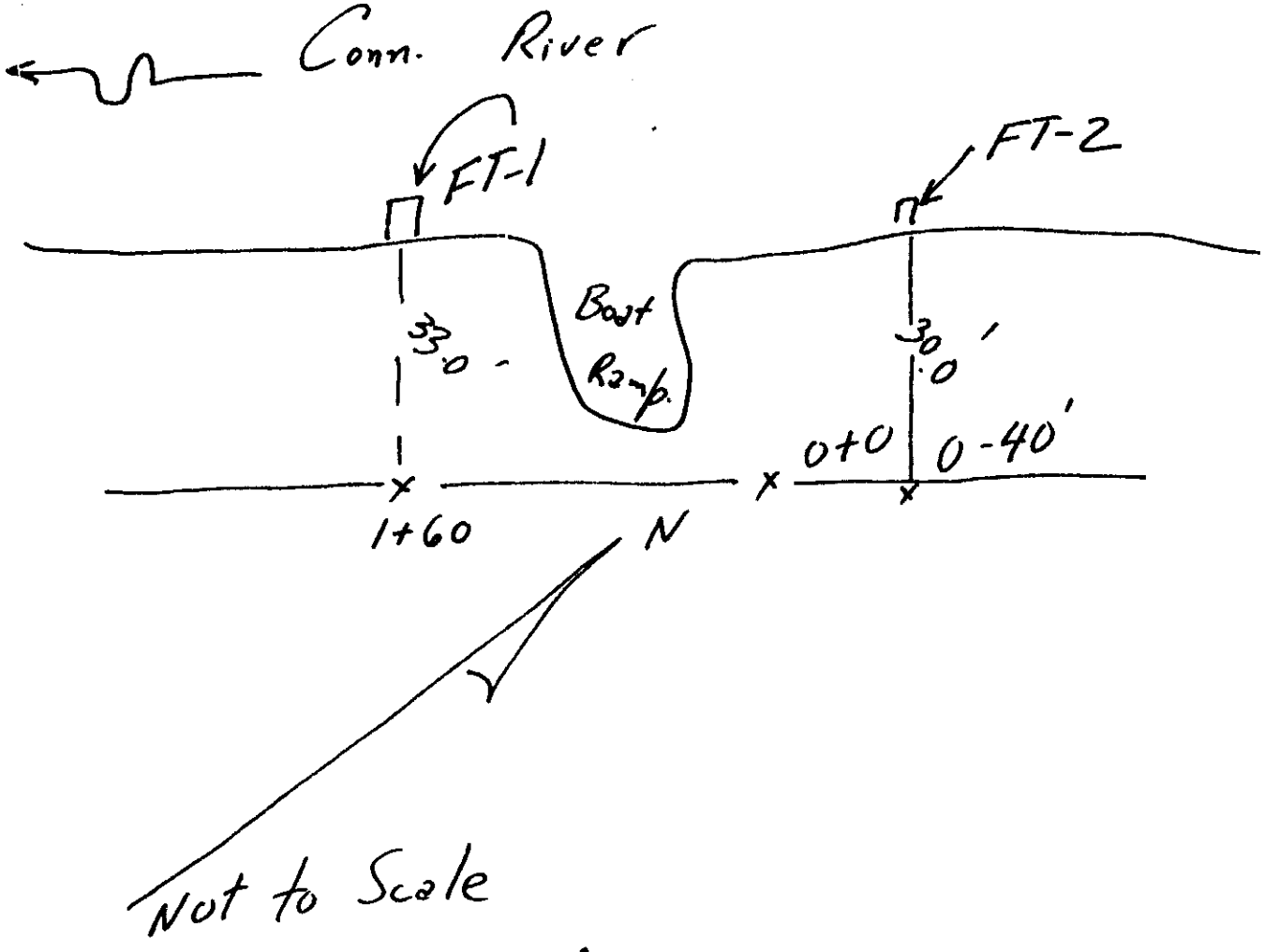
Remarks: PRELIMINARY

Submitted by C. Lynch

ED FORM DEC 63 119 REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

A-21

Vt Highway # US 5



Not to Scale

Stations by NED Survey Party

PRELIMINARY

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

STH 0-40' 50'FT

SITE #51

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

Connecticut River Bank Erosion Studies

SITE Hanover, NH TYPE EXPLORATION Test Trench DATE 5/74

EXPLORATION NO. ET-2 CO-ORD. N _____ E _____ GROUND ELEV. _____

PURPOSE OF EXPLORATION To determine type of material in bank section

DEPTH 1" = 2.0'	SAMPLES No.	SAMPLES Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.0	T-1	0.0-0.7		Topsoil, grass-roots	Step Trench. Hope using Hand Shovel & pick from 0.0' To 7.6. Unable To dig below 7.6 due to River Level @ 7.6'
	T-2	0.7		Tan fine Sandy Silt (ML)	
2.0	2 of 2	To		w/lt & dk brown Sand Striations	
5.0	T-3R	5.5		Moist	
5.5	T-4	5.5		Lt gray silty fine Sand (SM)	
6.0	2 of 2	To			
7.6	T-5R	7.6		Moist	
	Bottom of Exploration @ 7.6 (River Level)				

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-18" Diam. No. _____ Vol. _____ Cu. Ft.
Over 18" No. _____ Vol. _____ Cu. Ft.

WATER TABLE DEPTH _____

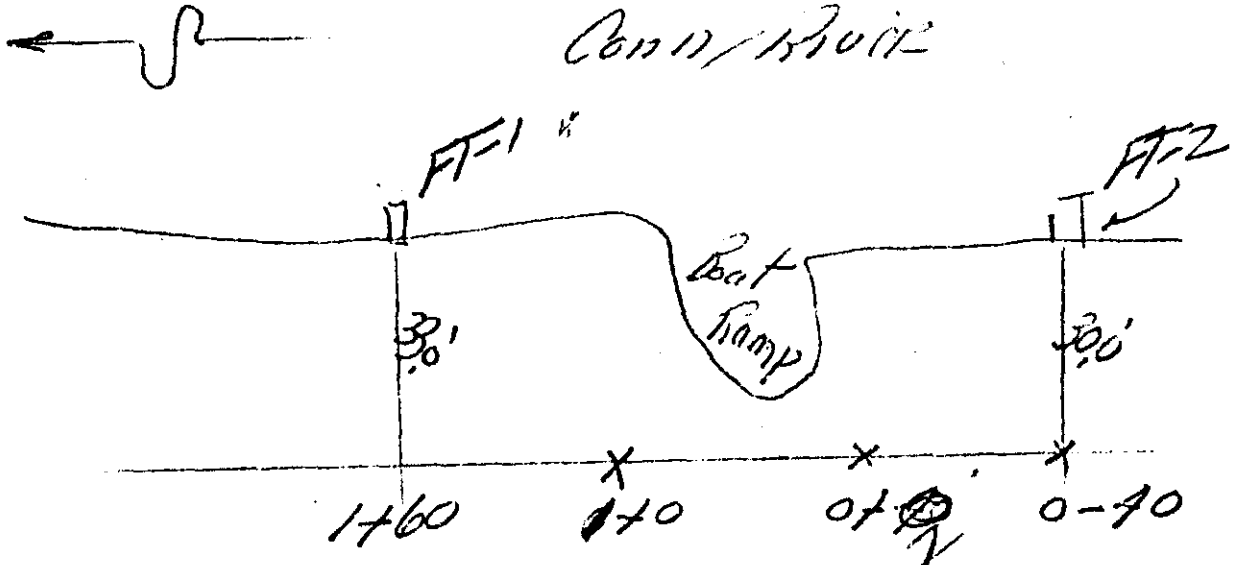
Remarks: PRELIMINARY

Submitted by _____

ED FORM 1119 DEC 63 REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

A-23

Vt. Highway #5



Not to scale

Stations by
NED survey party

PRELIMINARY

A-

Cornish NH site 31 — Sta 1+00 to 32' RT

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

Conn River Erosion Study

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Cornish NH TYPE EXPLORATION Test Trench DATE 6/6/75
EXPLORATION NO. C-TT-1 CO-ORD. N ____ E ____ GROUND ELEV. ____
PURPOSE OF EXPLORATION To determine Type of material in Bank Erosion

DEPTH, 1" = 5.0'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.6	S-1	0.0-0.6		Topsoil	Jog Test Step Trench on Slope using Hand Shovel & Pick from 0.0' To 35.4'. unable To dig below 35.4 due to water leach of River
	S-2 Comp	0.6 To		Tan silty fine Sand (SM)	
5.9	S-3R	5.9			
8.0	S-4	5.9		Gray brown fine Sandy Silt (ML)	
9.3	S-5R	7.3			
	S-6	9.3		LT Brown Silty fine Sand (SM)	
16.0	Comp	To			
	S-7R				
29.0		30.1			
30.1					
32.0	S-8 Comp	30.1 To		Brown Silty f-m Sandy Gravel (GM)	
35.4	Bottom of Exploration @ 35.4' @ River	35.4			level

DIMENSIONS OF TEST PIT ____ VOL. REPRESENTED ____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. ____ Vol. ____ Cu. Ft.
6"-12" Diam. No. ____ Vol. ____ Cu. Ft.
Over 12" No. ____ Vol. ____ Cu. Ft.

WATER TABLE DEPTH ____

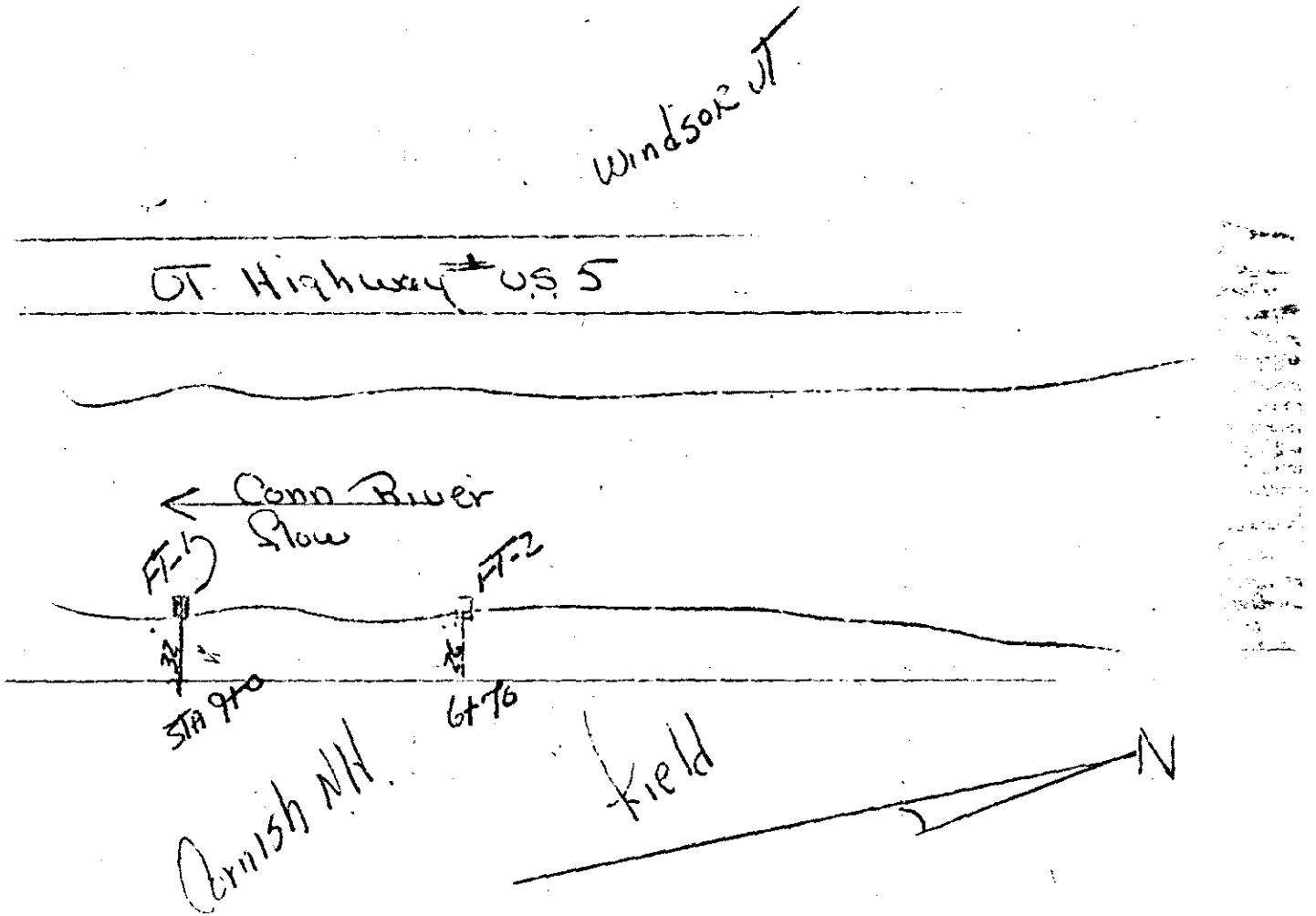
Remarks: PRELIMINARY

Submitted by S. Lynch

FORM DEC 63 119 — REPLACES EDITION OF AUG 62 WHICH MAY BE USED UNTIL EXHAUSTED

A-25

A-26



NOT To scale

Stations by N&D Survey party

Cornish NH Site #31

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

Sta 6+70 to 26.0 FT

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Cornish NH TYPE EXPLORATION Test Trench DATE 6/5/75
EXPLORATION NO. ET-2 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine type of material in Bank Erosion

DEPTH, 1" = 10.0'	SAMPLE'S No	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.5	J-1	0.0		Topsoil, roots, rocks	dug test Step Trench on slope using Hand shovel & pick from 0.0' to 45.6' - unable to dig below 45.6 due to water level @ 45.6'
	J-2 1 of 2	0.5		Brown fine sandy silt (till) (Cl)	
6.5	J-3R	6.5			
10.0	J-4	6.5		grey brown silty m-f sand (Sm) moist	
	2 of 2	To			
20.0'					
	J-5R	30.1			
30.0'					
30.1	J-6	30.1		Lt Brown silty, gravelly m-f sand (Sm) (Cl) 1' layer of Brown fine sand & grass	
40.0'	2 of 2	To			
		45.6			
45.6	Bottom of Exploration @ 45.6'				

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS:
4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-18" Diam. No. _____ Vol. _____ Cu. Ft.
Over 18" No. _____ Vol. _____ Cu. Ft.

WATER TABLE DEPTH _____

Remarks: PRELIMINARY

Submitted by C. Lynch

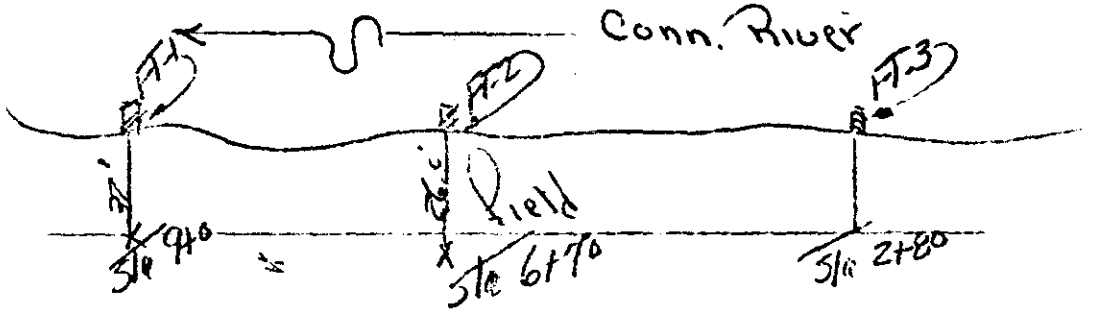
NED FORM 119

A-27

A-28

Windsor VT.

VT. Highway Rt #5



Cornish NH.

Brush & woods

N

NOT To Scale

Stations by N.E.D. Survey party

Cornish NH Site 3 CORPS OF ENGINEERS SHEET 2 OF 2 SHEETS

NEW ENGLAND DIVISION

FOUNDATIONS & MATERIAL BRANCH

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Cornish NH TYPE EXPLORATION Test Trench DATE 6/24/47

EXPLORATION NO. FT-3 CO-ORD. N _____ E _____ GROUND ELEV. _____

PURPOSE OF EXPLORATION To determine type of material in Bank Ground

DEPTH 1" = 10.0'	SAMPLE'S No	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.3				Lt Brown fine sandy silt (TOPSOIL)	Dug test trench using hand shovels & pick from 0.0' to 50.8 unable to dig below 50.8 due to river level —
3.1	T-2b	0.3			
	T-2c	3.1			
	T-1	3.1		Tr of brown silty fine sand (fill)	
10.0	20/2	Tr			
	T-3R	16.1			
16.1					
18.3	T-2	16.1		Brown silty fine sand (fill)	
20.0	20/2	18.3			
	T-3	18.3		Brown silty fine sand (fill)	
	20/2				
30.0	T-3c	Tr			
		47.0			
40.0					
47.0					Bottom of Exploration @ River level
50.8	T-10(2) T-11(2)	47.0 50.8		Brown fine sandy SILT (fill) (T-10c Dry SILT & SAND)	

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft.

6"-18" Diam. No. _____ Vol. _____ Cu. Ft.

Over 18" No. _____ Vol. _____ Cu. Ft.

WATER TABLE DEPTH _____

Remarks: PRELIMINARY

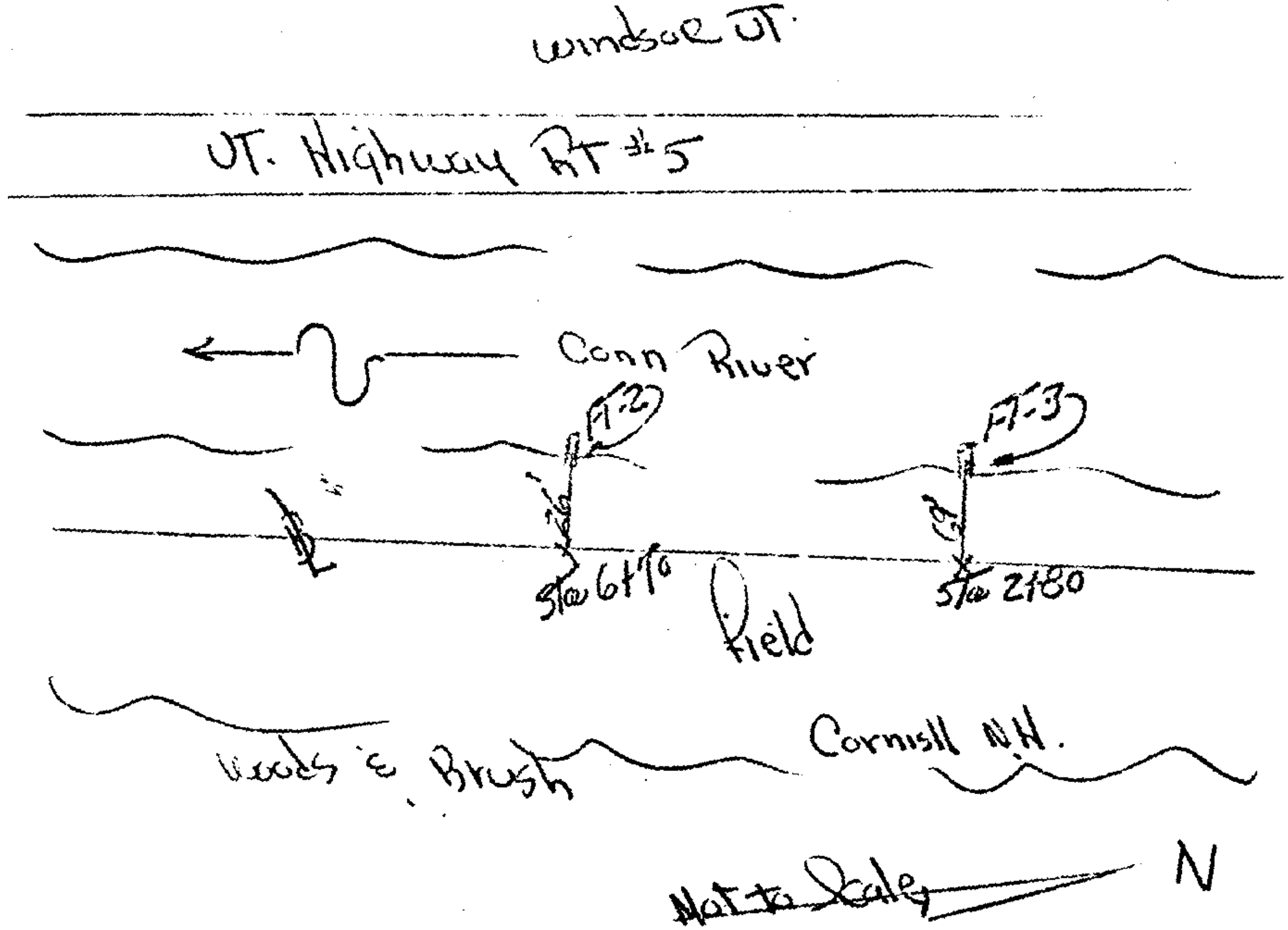
Submitted by _____

NCD FORM DEC 43 119 REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

A-29

A-30

PRELIMINARY



Stations by MED Survey Party

Cornish NH. site #31 CORPS OF ENGINEERS NEW ENGLAND DIVISION FOUNDATIONS & MATERIAL BRANCH Sta 0+74-79 'RT

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Cornish NH. TYPE EXPLORATION Test Trench DATE 6/29/
EXPLORATION NO. FT-4 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine Type of Material in Bank Erosion

DEPTH 1" = 10.0'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.0	S-1	0.0-6.5		Topsoil Grass roots	
	S-2	6.5		Grey silty fine Sand (SM)	dug Test Step Trench using Hand shovel & pick from 0.0 to 43.4 unable to dig below 43.4 due to River level @ 43.4
5.6	S-3R	5.6			
10.0	S-4 2 cft	5.6 to 14.8		Brown Silty C-F Sandy gravel (GM)	
14.8	S-5	14.8-15.7		Fine Sand (SM)	
15.7	S-6	15.7-18.7		dark brown fine sandy silt (ML)	
18.7	S-6R	15.7-18.7			
20.0	T-9 2 cft	18.7 to 34.9		Brown Silty fine Sand (SM) (w/ l.s of Cover or deposit of Bank cave)	
30.0	T-10R	34.9			
34.9	T-11R	34.9 to 36.9		grey brown silty C-F Sandy gravel (GM)	w/ l.s Cover of Bank Cave
36.9	T-12	36.9 to 43.4		Tan silty fine Sand (SM) (w/ l.s of Bank Cave)	
40.0	T-13R	43.4			
43.4	Bottom of Exploration @ 43.4' @ River Level				

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-12" Diam. No. _____ Vol. _____ Cu. Ft.
Over 12" No. _____ Vol. _____ Cu. Ft.

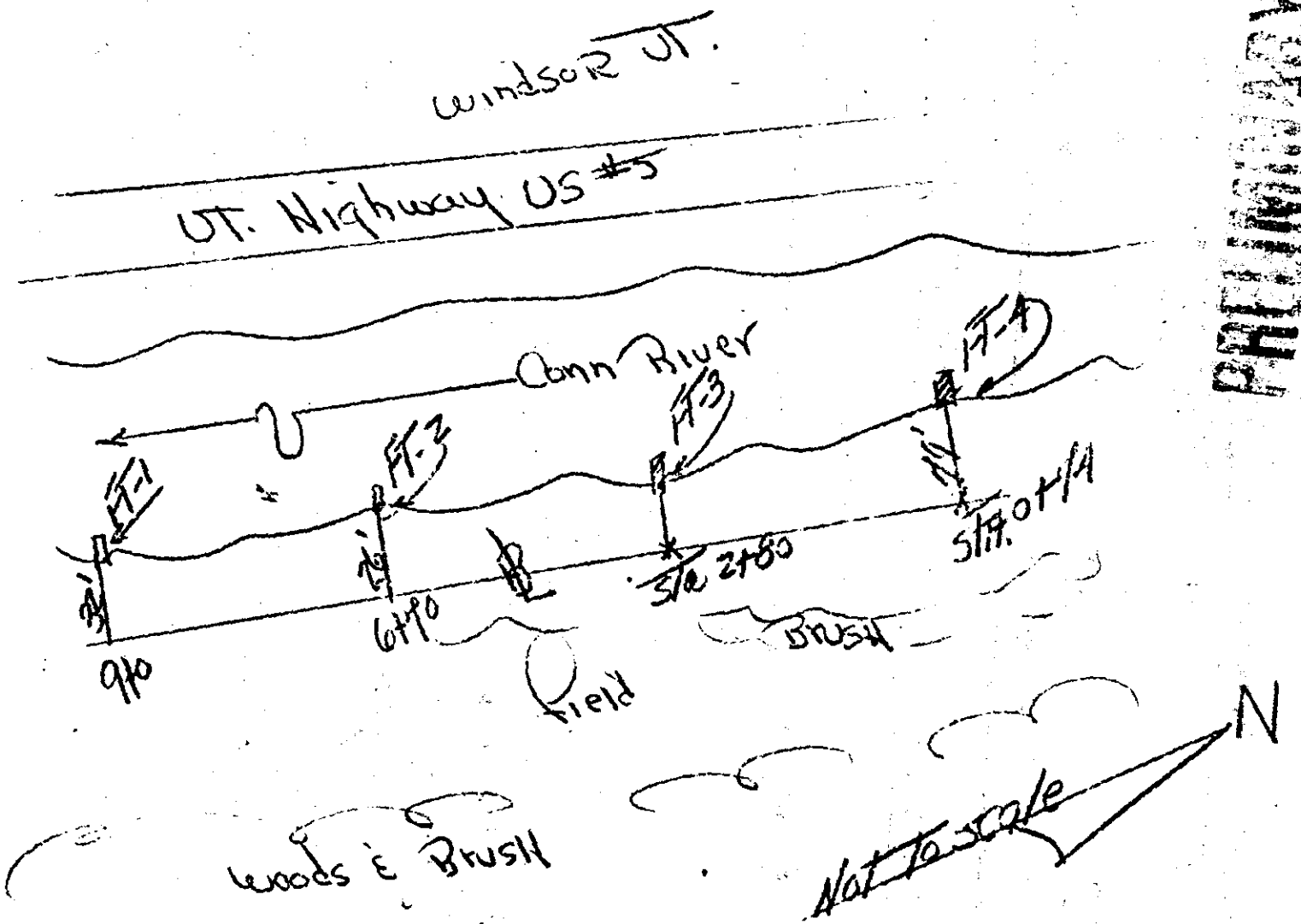
WATER TABLE DEPTH _____

Remarks: PRELIMINARY

Submitted by _____

NED FORM DEC 63 118 REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

A-31



Stations by NED Survey Party

Charlestown NH
Site #26

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

Site 15 F23 210 Lt of 6

River Erosion 1953

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Charlestown NH TYPE EXPLORATION Test Trench DATE 4/61
EXPLORATION NO. ET-1 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine Type of Material in Bank Erosion

DEPTH 1" = 3.0'	SAMPLE'S No	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.4	T-1	0.0 0.4		Topsoil grass roots	Dug Test Trench using Hand Shovel & pick from 0.0' To 13.6 - unable To dig Below 13.6 due to water level of River
		0.4		Brown fine Sandy Silt mix (w/ 1.1 of Fine) Grass Cover from Bank (Loc 10.2 To 13.6)	
3.0	T-2				
6.0	T-2 of 2	To			
9.0	T-3R				
12.0					
13.6		13.6		Bottom of Exploration @ 13.6' @ River Level	

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS:
4"-6" Diam. No. _____ Vol. _____ Cu. Ft
6"-18" Diam. No. _____ Vol. _____ Cu. Ft
Over 18" No. _____ Vol. _____ Cu. Ft.

WATER TABLE DEPTH

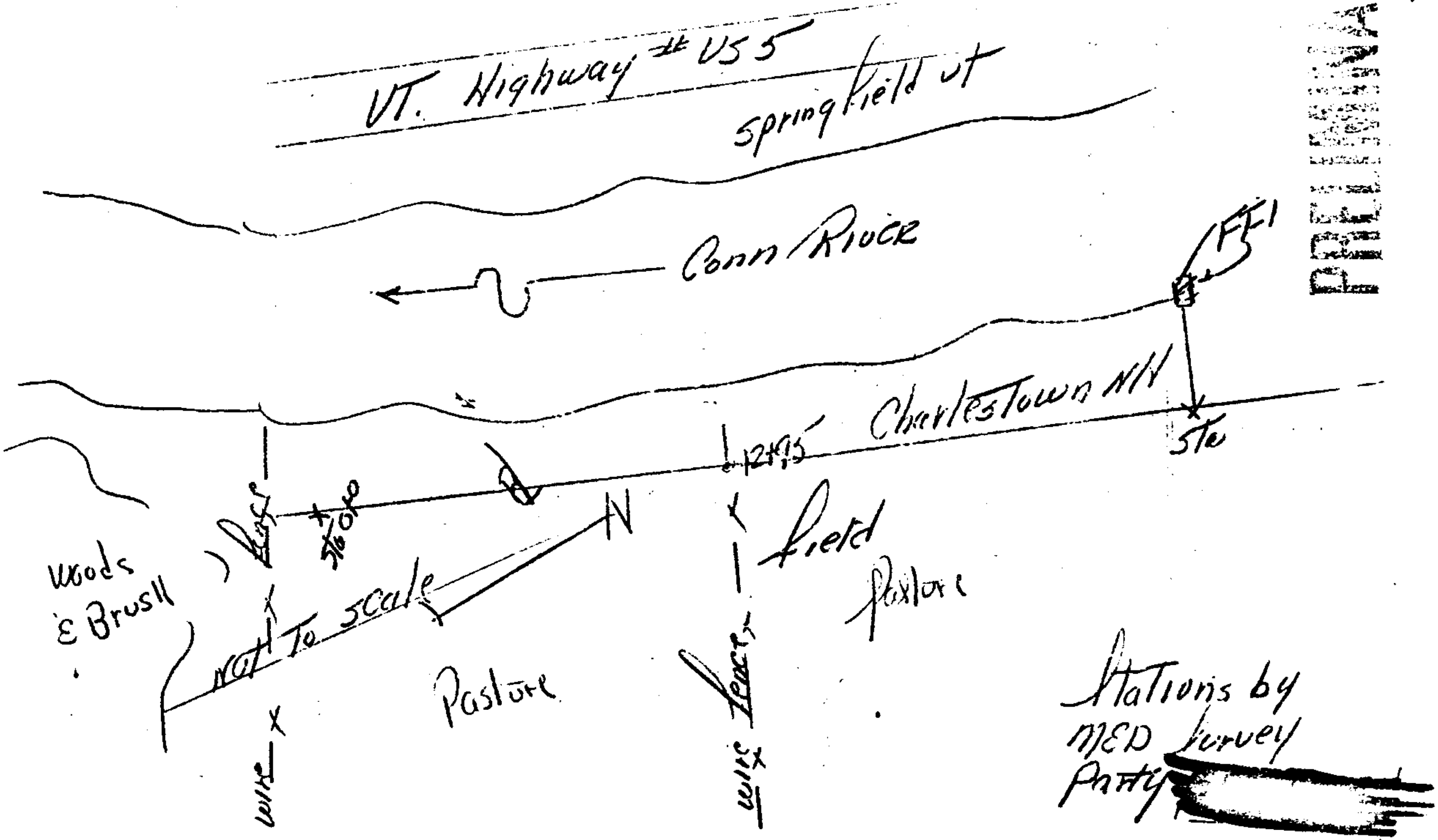
Remarks: PRELIMINARY

Submitted by C. Tocchi

NED FORM 119 DEC 63

REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

A-33


VT. Highway # US 5
springfield vt
Conn River
FF1
Charlestown NH
Sta
1295
field
Pasture
Woods & Brush
not to scale
N
Pasture
wire
wire fence
Stations by
MED Survey
Party [redacted]

Charlestown NH
Site #26

CORPS OF ENGINEERS 5 to 7 to 21.0 Lt of ℄
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

nn River Erosion Study

SITE Charlestown NH TYPE EXPLORATION Test Trench DATE 6/24/76
EXPLORATION NO. TT-2 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine type of material in Bank Erosion

DEPTH 1" = 4.0'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.8	J-1	0.0-0.8		Topsoil grass & roots	
	J-2	0.8		Brown fine sandy silt (ML) w/roots moist	Dug test trench using pick & hand shovel from 0.0 to 16.4'
4.0	20 1/2	to			
8.0	J-3R	11.1			Unable to dig below 16.4 due to River level
11.1					
12.0	J-4	11.1		Gry silty fine sand (SM) slit stratified moist	
	20 1/2	to			
16.0	J-5R	16.4			
16.4	Bottom of Exploration @ 16.4 @ River Level				

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-18" Diam. No. _____ Vol. _____ Cu. Ft.
Over 18" No. _____ Vol. _____ Cu. Ft.

WATER TABLE DEPTH _____

Remarks: PRELIMINARY

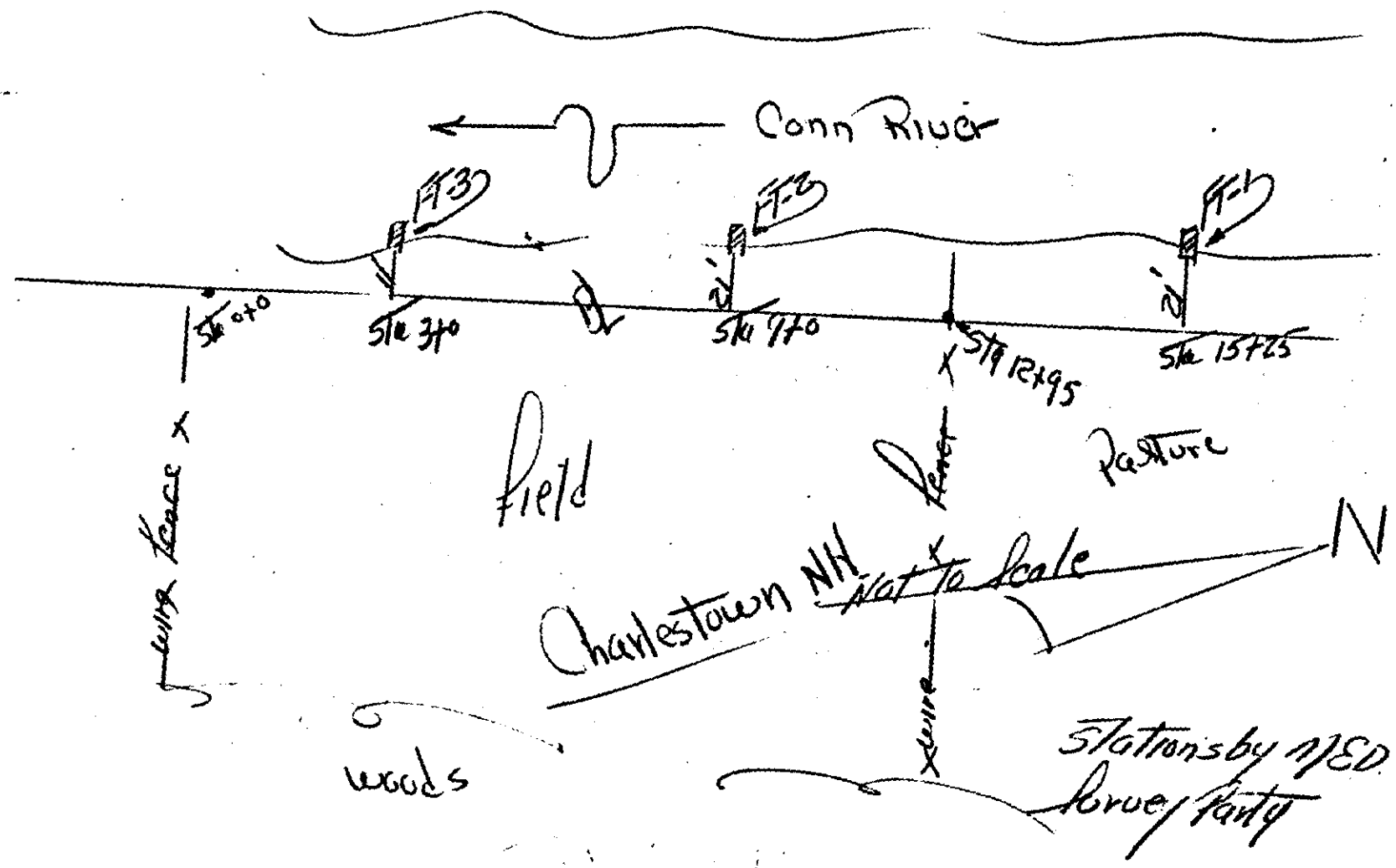
Submitted by C. Lynch

NED FORM DEC 63 119 REPLACES EDITION OF AUG 57 WHICH MAY BE USED UNTIL EXHAUSTED

A-35

Springfield VT

VT Highway # US5



PRELIMINARY

A-36

Westown NH
#26

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

5k 340 110 4 of 6

Con River Erosion Study

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Charlestown NH TYPE EXPLORATION Test Trench DATE 6/11
EXPLORATION NO. FT-3 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine type of Material in Bank Erosion

DEPTH 1" = 5.0'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.7	J-1	0.0 0.7		topsoil grass roots	Dig Test Step Trench using hand shovel & pick from 0.0 To 15.3 unable to dig below 15.3 due to River Level
	J-2	0.7		Brown fine Sandy Silt (SmL) w/roots	
	2 of 2	To			
5.0	J-3R	6.3		moist	
	J-4	6.3		Grey Silty fine Sand (Sm) Silt Stratified	
10.0	2 of 2	To			
14.4	J-5R	14.4		moist	
15.0	5 of 2	14.4		Brown Silty fine Sand (Sm) moist	
15.3	J-TR	15.3			
	Bottom of Exploration @ 15.3 @ River Level →				

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft
6"-18" Diam. No. _____ Vol. _____ Cu. Ft
Over 18" No. _____ Vol. _____ Cu. Ft.

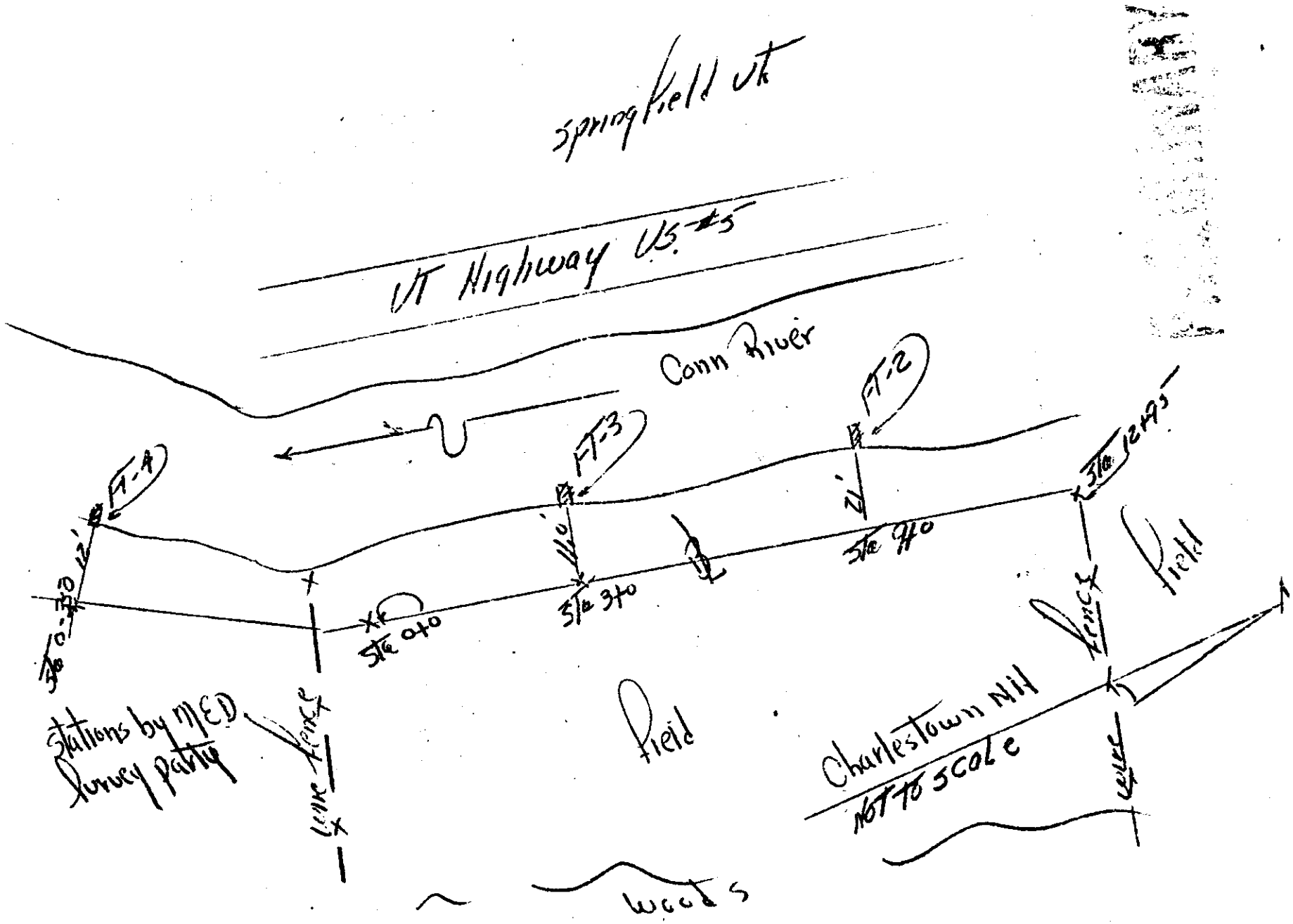
WATER TABLE DEPTH _____

Remarks: PRELIMINARY

Submitted by C Lynch

NED FORM DEC 63 119 REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

A-37


Springfield VT
VT Highway US #5
Conn River
FT-1
FT-2
FT-3
Sta 0+00
Sta 3+00
Sta 12+45
Stations by NED survey party
Line Fence
Field
Woods
Charlestown NH
NOT TO SCALE

Charlestown NH
site #26

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

Ste. 0-350 12' Ht of R

Inn River Erosion Study

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Charlestown NH TYPE EXPLORATION Test Trench DATE 6/5/76
EXPLORATION NO. FT-1 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION to determine the Type of material in Bank Erosion

DEPTH 1" = 3.0'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.5	FT-1	0.0-0.5		Topsoil grass & roots	dug test trench using hand shovel & pick from 0.0' to 11.2 – unable to dig below 11.2 due to River level
	FT-2	0.6		Brown fine Sandy Silt (ML) w/roots in just	
3.0'	2 of 2	F			
	FT-3E	6.6			
6.0'					
6.6					
	FT-4	6.6		Brown fine Sandy Silt (ML) w/roots (Borderline ML)	
9.0'	2 of 2	F			
	FT-5E	11.2			
11.2					
12.0'	Bottom of Exploration @ 11.2' to River Level				

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

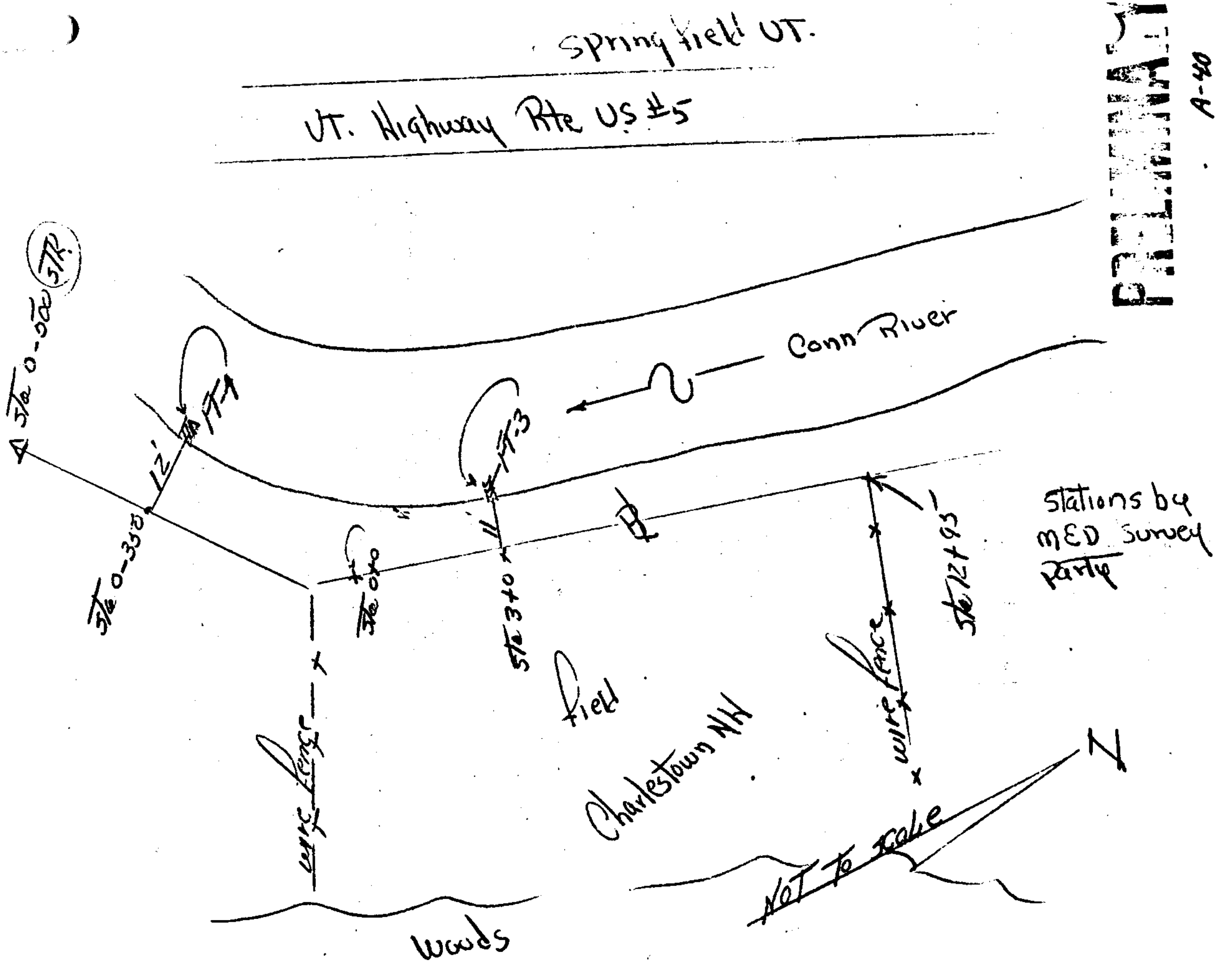
COBBLES & BOULDERS:
4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-12" Diam. No. _____ Vol. _____ Cu. Ft.
Over 12" No. _____ Vol. _____ Cu. Ft.

WATER TABLE DEPTH _____

Remarks: _____

Submitted by C Lynch

NED FORM DEC 63 119 REPLACES EDITION OF AUG 67 WHICH MAY BE USED UNTIL EXHAUSTED


Springfield VT.
VT. Highway Rte US #5
Conn River
PT-4
PT-3
12'
11'
Sta 0-500
STR
Sta 0-350
Sta 0+0
Sta 3+0
Sta 12+93
Stations by MED Survey Party
wire fence
wire fence
field
Charlestown NH
NOT to scale
N
Woods
A-40

Dummerston VT.
Site #90A

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

STA 21+00 26 Lt of ℄

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Dummerston VT. TYPE EXPLORATION Test Trench DATE 6/3/7[illegible]

EXPLORATION NO. TT-1 CO-ORD. N ______ E ______ GROUND ELEV. ______

PURPOSE OF EXPLORATION To determine the Type of Material in Bank Erosion

DEPTH 1" = 4.0'	SAMPLES No.	SAMPLES Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.9	T-1	0.0-0.9		Topsoil grass roots	dug test Hp Trench
1.3	T-2	0.9-1.3		Brk brown fine sandy silt (ML) w/ roots	Using Hand Shovel
2.6	T-3	1.3-2.6		Tan silty fine sand Silty w/ roots	& pick from 0.0 To
4.0	T-6	2.6			16.6' - unable to dig
	to 2			Lt Brown to grey silty fine sand (Sm)	below 16.6 due To
8.0					River Level
		to			
	T-1R				
12.0					
		16.6			
16.0					
16.6	Bottom of Exploration @ 16.6' @ River Level				

DIMENSIONS OF TEST PIT ______ VOL. REPRESENTED ______ CU. FT.

COBBLES & BOULDERS:
4"-6" Diam. No. ______ Vol. ______ Cu. Ft.
6"-10" Diam. No. ______ Vol. ______ Cu. Ft.
Over 10" No. ______ Vol. ______ Cu. Ft.

WATER TABLE DEPTH ______

Remarks: ______

PRELIMINARY

Submitted by C. Lynch

NED FORM DEC 63 119

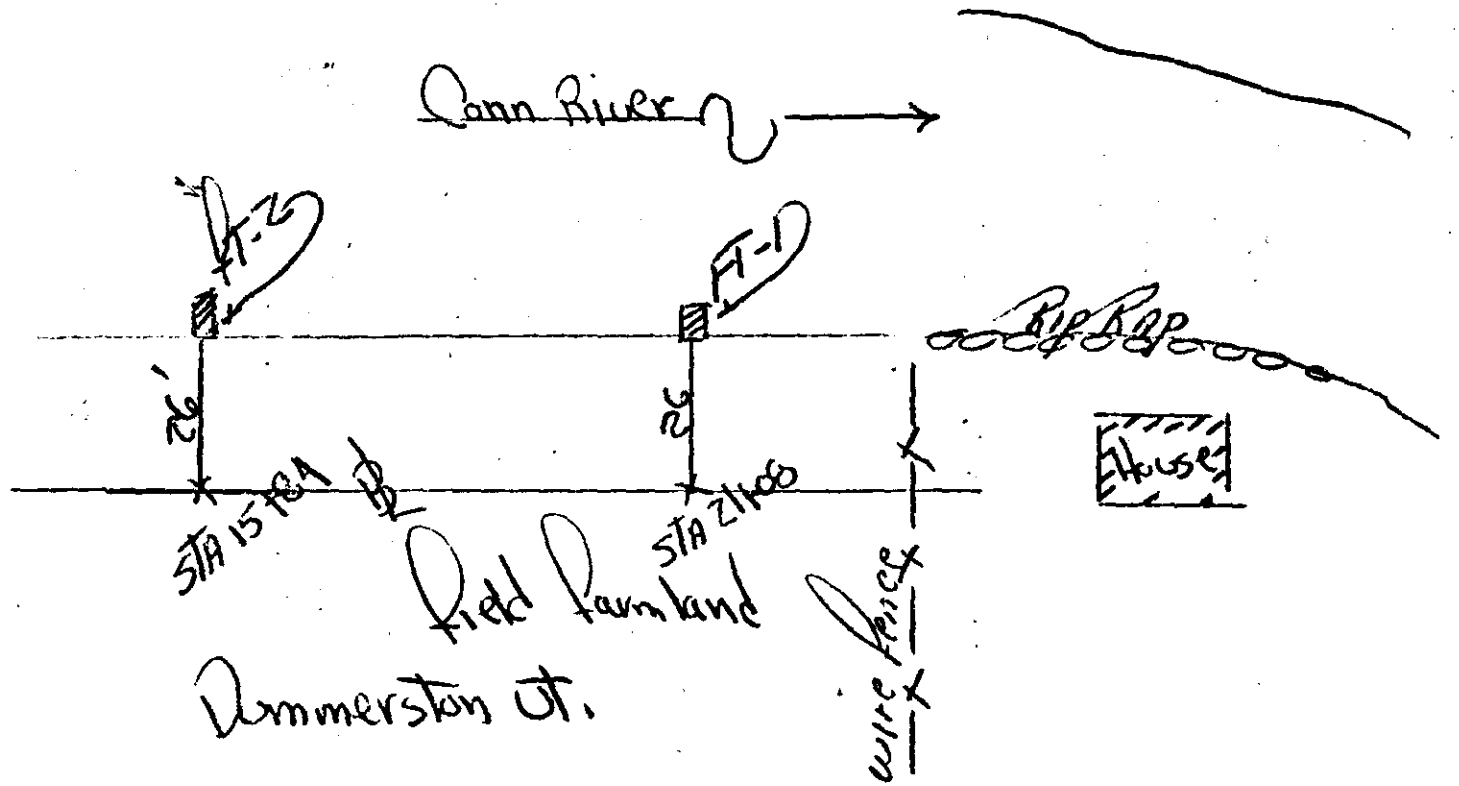
REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

N

Not to scale

Chesterfield, NH

Stations by MED. Survey party



Dummerston ~~##~~ VT
site #90 A

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

STA 13781 26' Lt of ℄

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Dummerston VT TYPE EXPLORATION Test Trench DATE 6/9/
EXPLORATION NO. T-T-2 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine the type of material in Bank Erosion

DEPTH 1" = 10'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
3.1'	T-1	0.0-0.7		Topso: Grass roots	Dug Test Step Trench using Hand Shovel & pick from 0.0 to 21.1. unable to dig below 21.1 due to River level
5.0'	T-2	0.7		Brown silty fine sand (Sm) w/ 1.3' of Cover of silt & sand & grass from Bank Cave	
	2.0'	to			
10.0'					
15.0'	T-3				
		21.1			
20.0					
21.1	Bottom of Exploration @ 21.1' @ River level				

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft
6"-18" Diam. No. _____ Vol. _____ Cu. Ft
Over 18" No. _____ Vol. _____ Cu. Ft

WATER TABLE DEPTH _____

Remarks: PRELIMINARY

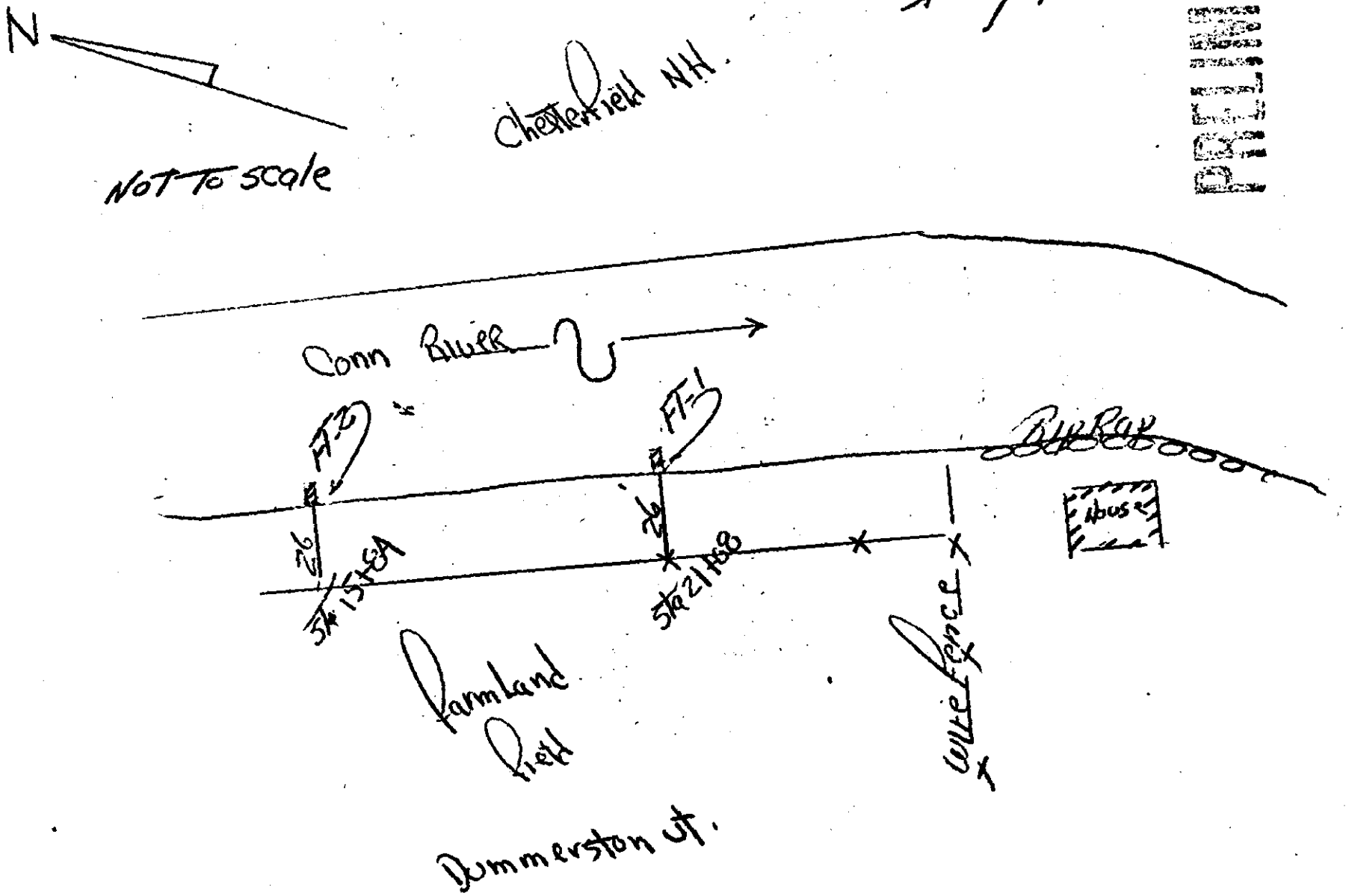
Submitted by C. Lynch

NED FORM DEC 63 119

REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

A-43

Stations by NED survey party



Dummerston VT
Site #90A

CORPS OF ENGINEERS Sht 7 of 25 46 Lt of 12
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

Conn River Basin Study

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Dummerston VT TYPE EXPLORATION Test Trench DATE 6/21/76
EXPLORATION NO. ET-3 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine type of material in bank erosion

DEPTH 1" = 3.0'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.5				Brown grass roots	
	T-2 2of2	0.5 To		Brown fine sandy SILT (ML) w/ roots	dig Test Pit Trench using Hand shovel & pick from 0.0' To 19.6' - unable To dig below 19.6 due To River Level
3.5'	T-3R	1.5			
7.5				Sitty LT Brown fine sandy (SM)	
10.0	T-4 2of2	1.5 To			
15.0'	T-5R	18.1		Note 7.5-19.6 Had 0.9' of Cover (SM) & ML + Grass From Bank Cave	
18.1	S-6C	18.1		Dark grey brown Silty M-F sand (SM)	
19.6	S-7C	19.6			
20.0	Bottom of Exploration @ 19.6				@ River Level

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-18" Diam. No. _____ Vol. _____ Cu. Ft.
Over 18" No. _____ Vol. _____ Cu. Ft.

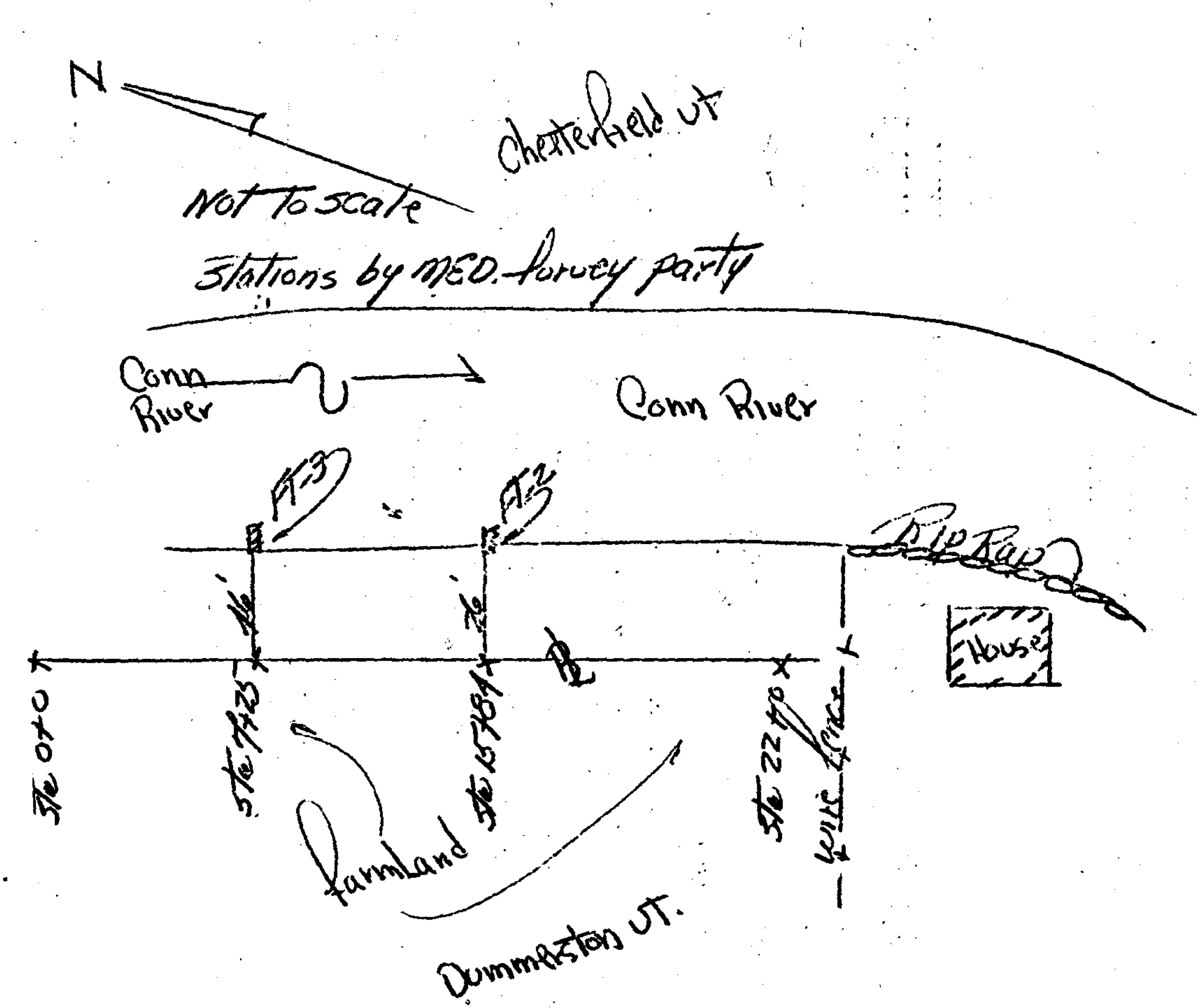
WATER TABLE DEPTH _____

Remarks: _____

Submitted by C. Lynch

NED FORM DEC 63 119 REPLACES EDITION OF AUG 62 WHICH MAY BE USED UNTIL EXHAUSTED

A-45



Dummerston VT. Site 290 4

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

Site 270 290 4 of 8

Connecticut River Basin Study

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Dummerston VT TYPE EXPLORATION Test Trench DATE 6/11/15
EXPLORATION NO. FT-1 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine type of material in BANK Erosion

DEPTH 1" = 5.0'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.5	T-1	0-0.5		Typical grass roots	dig w/ hand shovel & pick Test Trench From 0.0 To 19.9' - unable To dig below 19.9 due To River Level
	T-2	0.5		Brown fine Sandy Silt (ml) w/ roots	
5.0'	2 of 2	To			
10.0'	T-3K	11.7			
11.7	T-4 2 of 2	11.7 To .K		grey/ brown silty fine sand (sm)	note 11.7 To 19.9 had 0.9 of Boulder (sm) (ml) + grass
15.0'	T-5K	15.6			
18.6	T-6K	18.6		Dark grey brown silty m-f sand sm	
19.9	T-7K	19.9			
20.0	Bottom of Exploration @ 19.9				@ Rock Level

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS:
4"-6" Diam. No. _____ Vol. _____ Cu. Ft
6"-18" Diam. No. _____ Vol. _____ Cu. Ft
Over 18" No. _____ Vol. _____ Cu. Ft

WATER TABLE DEPTH _____

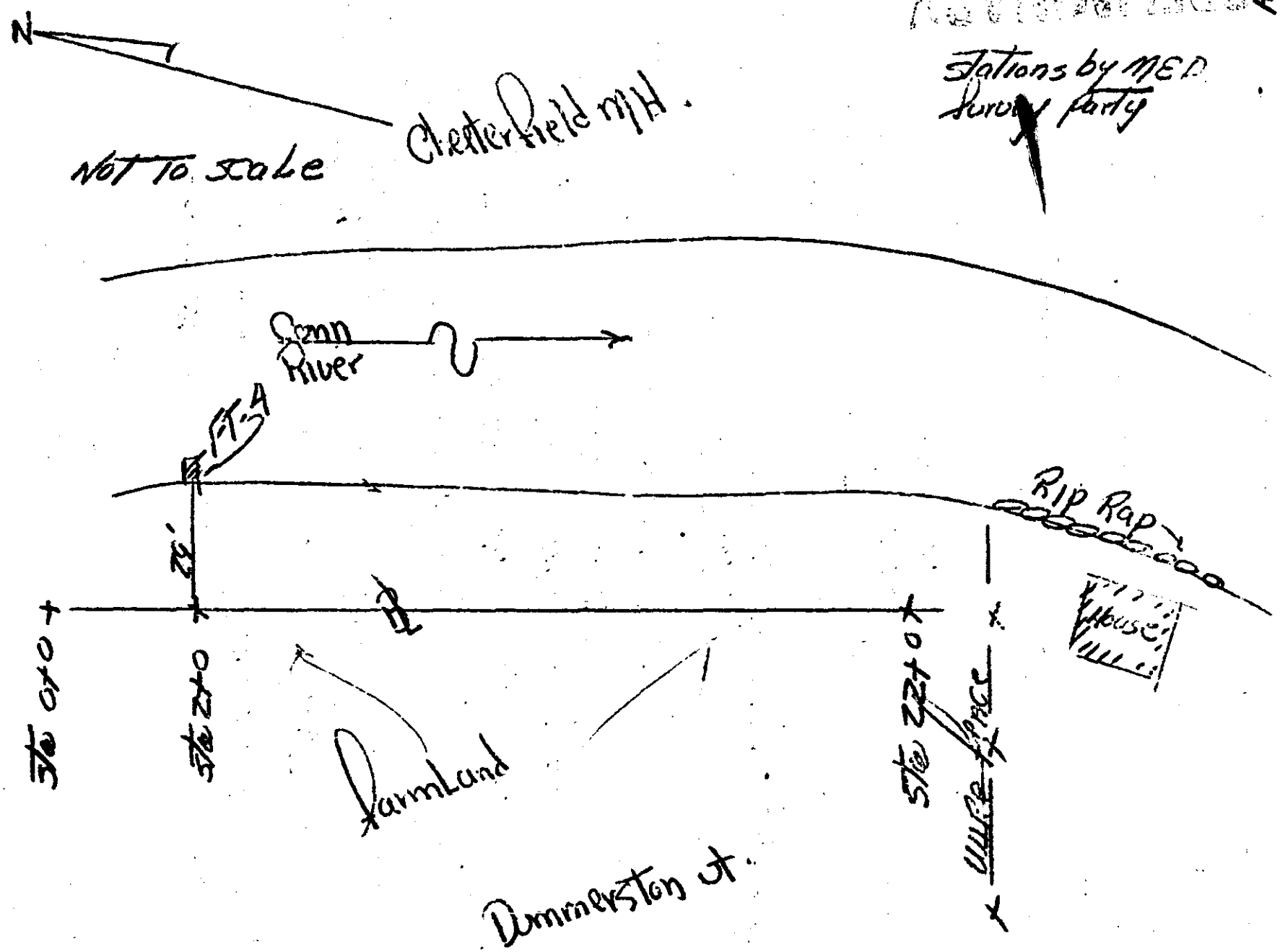
Remarks: PRELIMINARY

Submitted by C Lynch

NED FORM DEC 63 119

REPLACES EDITION OF AUG 57 WHICH MAY BE USED UNTIL EXHAUSTED

A-47


N
Chesterfield n/H.
NOT TO SCALE
Stations by MED
Survey party
Conn
River
PT-A
22'
RIP Rap
Sta 0+00
Sta 2+40
Sta 22+00
Farmland
Dunnerston St.

Till Mass
Site #255

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Till Mass TYPE EXPLORATION Test Trench DATE
EXPLORATION NO. TT-1 CO-ORD. N ____ E ____ GROUND ELEV. ____
PURPOSE OF EXPLORATION To determine the Type of material

DEPTH 1" = 5.0'	SAMPLES No.	SAMPLES Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.6	J-1	0.0-0.6		Topsoil, grass roots	dug w/ hand shovel & pick Test Trench from 0.5 to 19.9' unable to dig below 19.9 due to River Level
5.0	J-2	5.6		Brown fine sandy silt (sik)	
	tol				
6.6	J-3	6.6		w/ roots	
10.5	J-4			Brown & gray silty fine sand (sm)	
	tol				
14.4	J-5			Note: brown silt & sed cover ... to 16.6 of 0.8'	
15.0		15.6			
16.6	J-6	16.6		gray silty fine sand	
19.9 / 20.0	tol J-7	19.9			

Bottom of Exploration @ 19.9 @ River level

DIMENSIONS OF TEST PIT ____ VOL. REPRESENTED ____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. ____ Vol. ____ Cu. Ft
6"-18" Diam. No. ____ Vol. ____ Cu. Ft
Over 18" Diam. No. ____ Vol. ____ Cu. Ft.

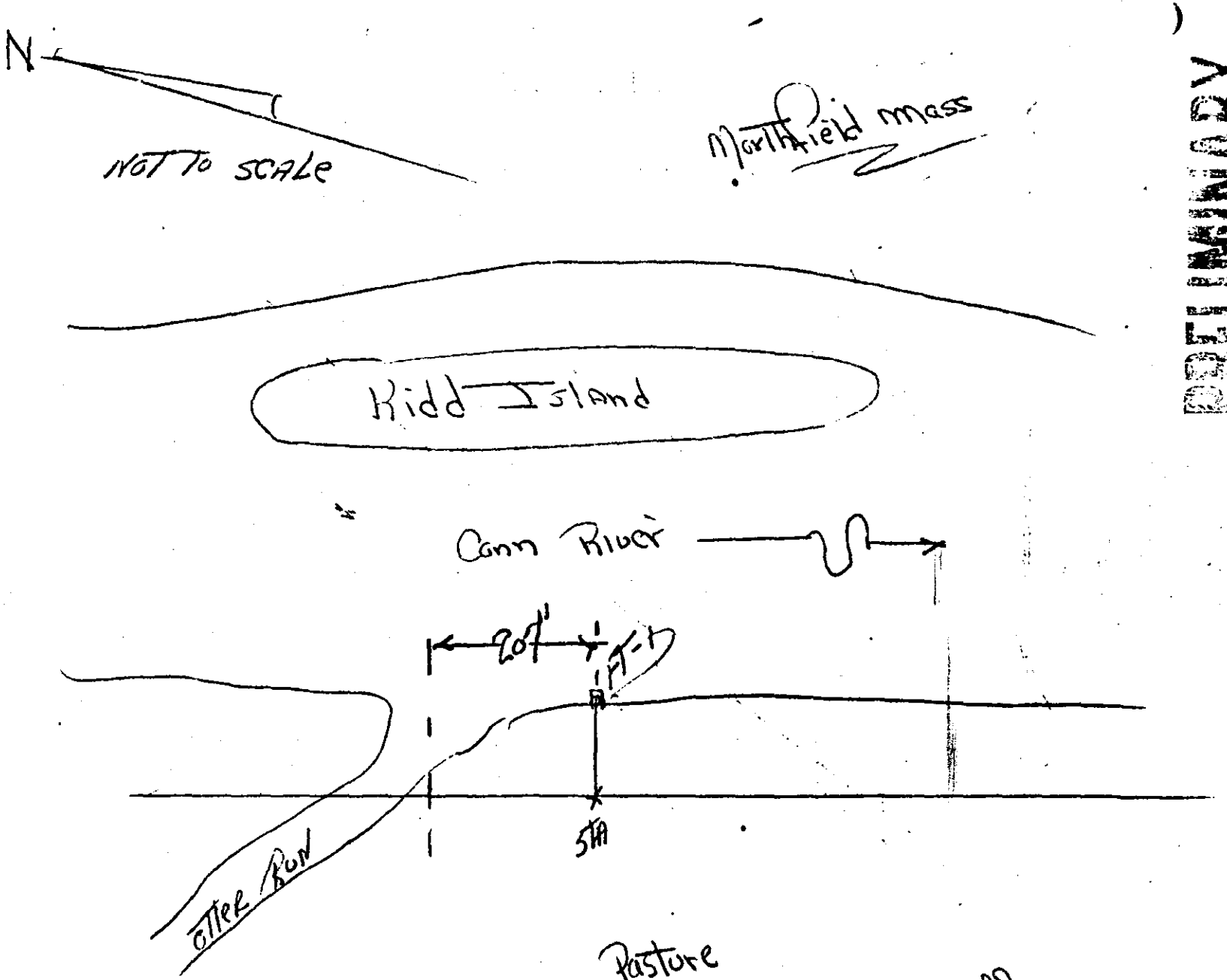
WATER TABLE DEPTH ____

Remarks: PRELIMINARY

Submitted by [signature]

NED FORM 110

A-49



Gill Mass
Site #253

CORPS OF ENGINEERS S/H
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

Conn River Cross FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Gill Mass TYPE EXPLORATION Test Trench DATE 6/11/[illegible]
EXPLORATION NO. T-1-2 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine Type of Material in Bank Erosion

DEPTH 1" = 5.0'	SAMPLE'S No	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.6	J-1	0.0-0.6		Topsoil grass roots	dug w/ Hand Shovel & pick Test Trench From 0.0 To 20.5 — unable to dig below 20.5' due to Rock Level
	J-2 20f2	0.6 To		Brown fine Sandy Silt (ML) w/roots	
5.0					
6.8	J-3R	6.8			
	J-4 20f2	6.8 To		Brown Silty fine Sand (Sm)	
10.0					
15.0	J-5R	16.9			
16.9					
	J-6 20f2	16.9		Grey Silty fine Sand (Sm) Silt Stratified	
20.0	J-7R	20.5			
20.5	Bottom of Exploration @ 20.5 (Rock Level				

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-18" Diam. No. _____ Vol. _____ Cu. Ft.
Over 18" No. _____ Vol. _____ Cu. Ft.

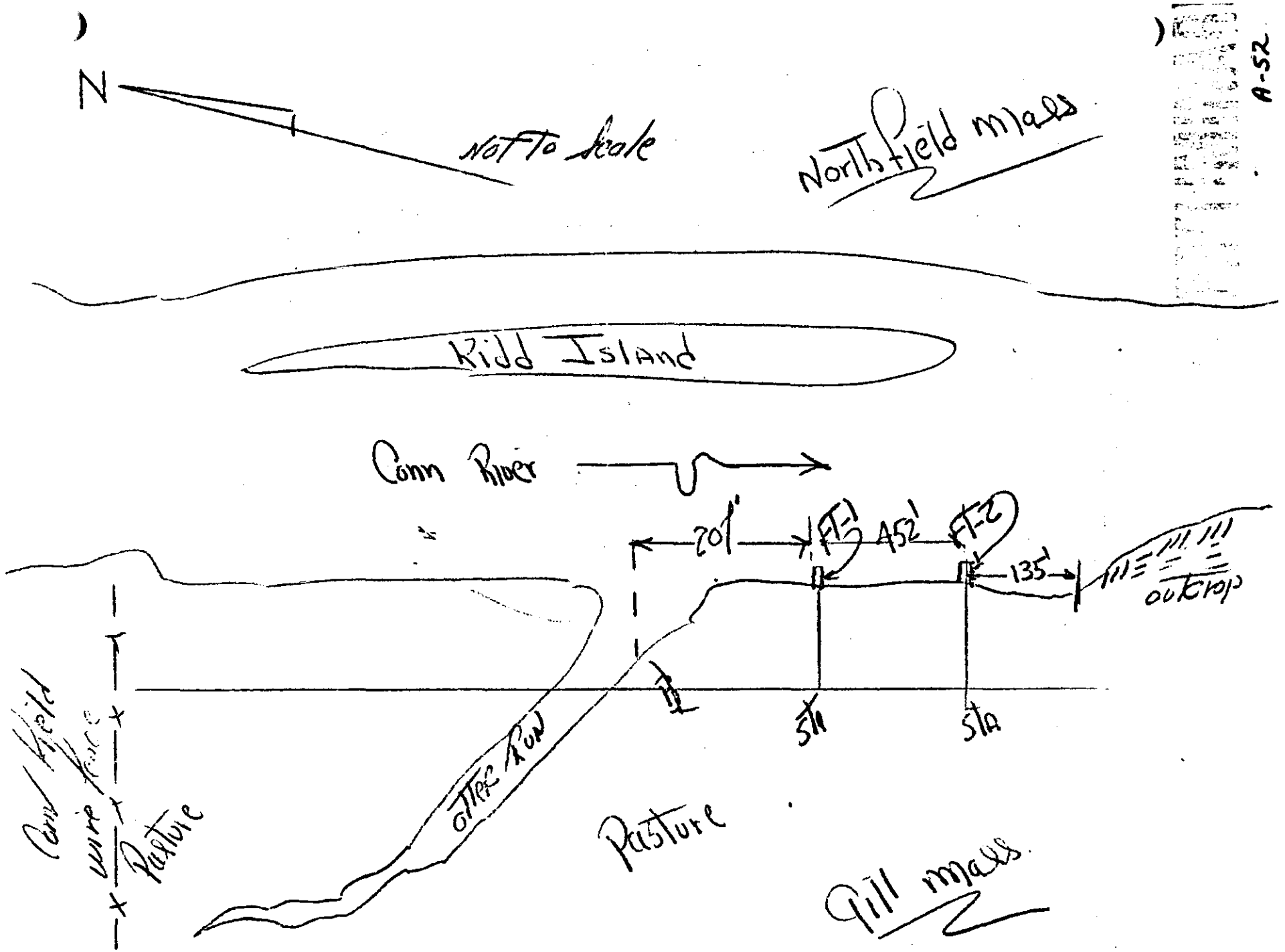
WATER TABLE DEPTH _____

Remarks: PRELIMINARY

Submitted by C Lynch

NED FORM 1119 DEC 63 REPLACES EDITION OF AUG 57 WHICH MAY BE USED UNTIL EXHAUSTED

A-51


N
Not To Scale
Northfield Mass
Kidd Island
Conn River
20'
FT-1
452'
FT-2
135'
outcrop
Conn Field
Pasture
Otter Run
Pasture
Till mass

Gill Mass.
Site #255

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

Conn River Erosion Study

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Gill Mass TYPE EXPLORATION Test Trench DATE 6/11/
EXPLORATION NO. FT-3 CO-ORD. N ____ E ____ GROUND ELEV. ____
PURPOSE OF EXPLORATION To determine type of material in bank erosion

DEPTH 1" = 5'	SAMPLES No.	SAMPLES Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.5	J-1	0.0-0.5		Topsoil/grass roots	Dug w/ hand & bucket & pick test trench from 0.0 to 16.5 - unable to dig below 16.5 due to river level
	J-2	0.5		grey brown sandy silt (ML) w/ flat sand seams -	
5.0	20 lb	To			
10.0	J-3R	13.5			
13.8					
	J-4	13.5		grey brown silty fine sand (SM)	
15.0	20 lb	To			
16.5	J-5R	16.5			
	Bottom of Exploration @ 16.5' @ river level				

DIMENSIONS OF TEST PIT ____ VOL. REPRESENTED ____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. ____ Vol. ____ Cu. Ft.
6"-12" Diam. No. ____ Vol. ____ Cu. Ft.
Over 12" No. ____ Vol. ____ Cu. Ft.

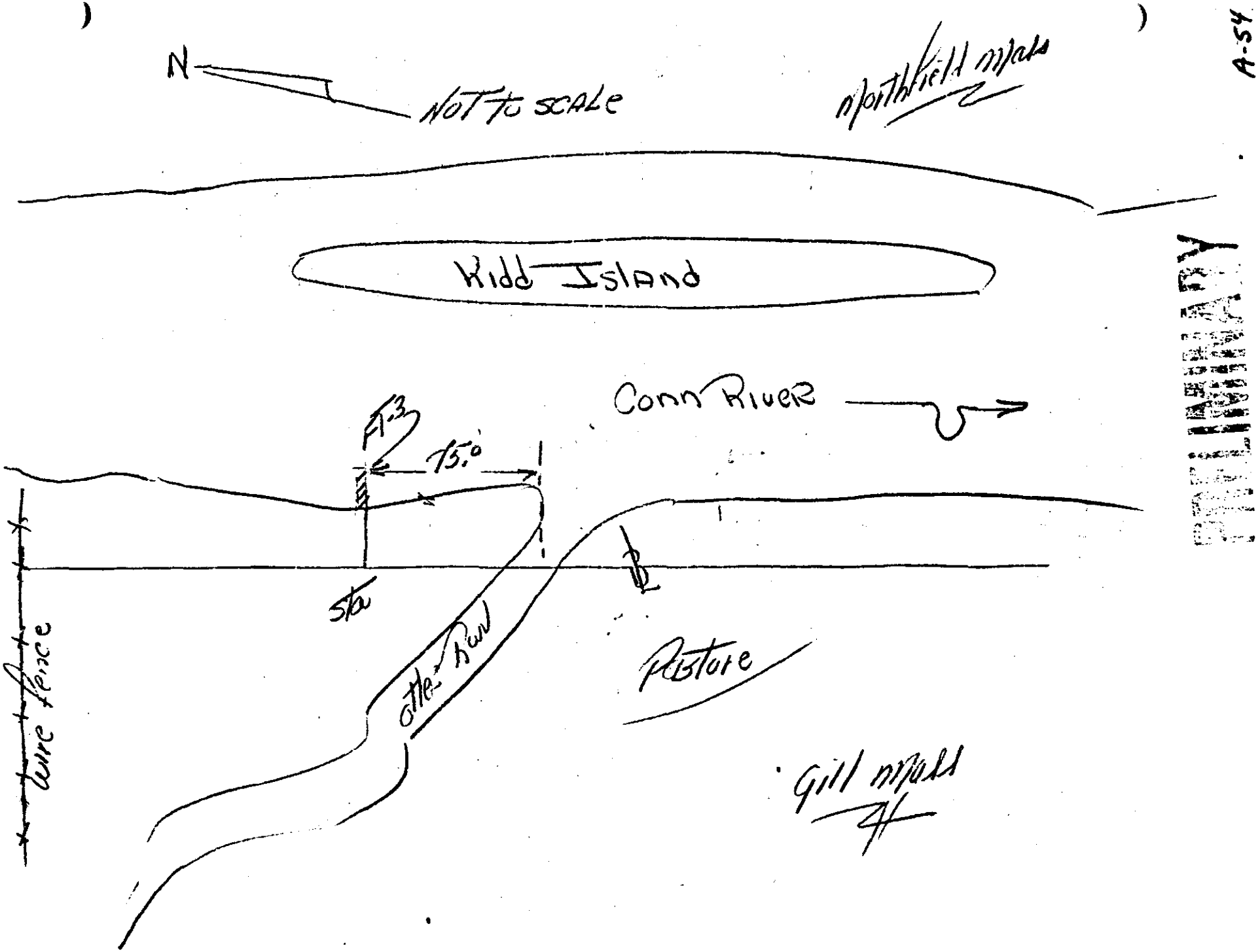
WATER TABLE DEPTH ____

Remarks: PRELIMINARY

Submitted by C. Lynch

NED FORM DEC 63 119 REPLACES EDITION OF AUG 57 WHICH MAY BE USED UNTIL EXHAUSTED

A-53


N
NOT TO SCALE
Northfield Mass
Kidd Island
Conn River
F1-3
75.0'
Sta
Barbed wire fence
Otter Brook
Pasture
Gill Mass

Pike Mass.
TA = 255

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

STA -

in Bank Erosion Study

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

SITE Pike Mass TYPE EXPLORATION Test Trench DATE 6/5/76
EXPLORATION NO. FT-4 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine type of material in Bank Erosion

DEPTH 1" = 5.0'	SAMPLE'S No	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.6	J-1	0.0 0.5		Topsoil Grass roots	dug w/ hand shovel & pick Test Trench from 0.0 to 22.1 - Unable to dig below 22.1 due to water Level
	J-2 20#'s	0.5 To		Brown fine Sandy Silt (ML) w/roots	
5.0					
7.8	J-3C	7.8			
10.0	J-4 20#'s	7.8		Grey brown silty fine Sand (SM) w/dark grey Silt Mat - 21# - 22.1'	
		To			
15.0'					
	J-5C				
20.0'		22.1			
22.1		Bottom of Exploration @ 22.1'			(at Water Level)

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-18" Diam. No. _____ Vol. _____ Cu. Ft.
Over 18" No. _____ Vol. _____ Cu. Ft.

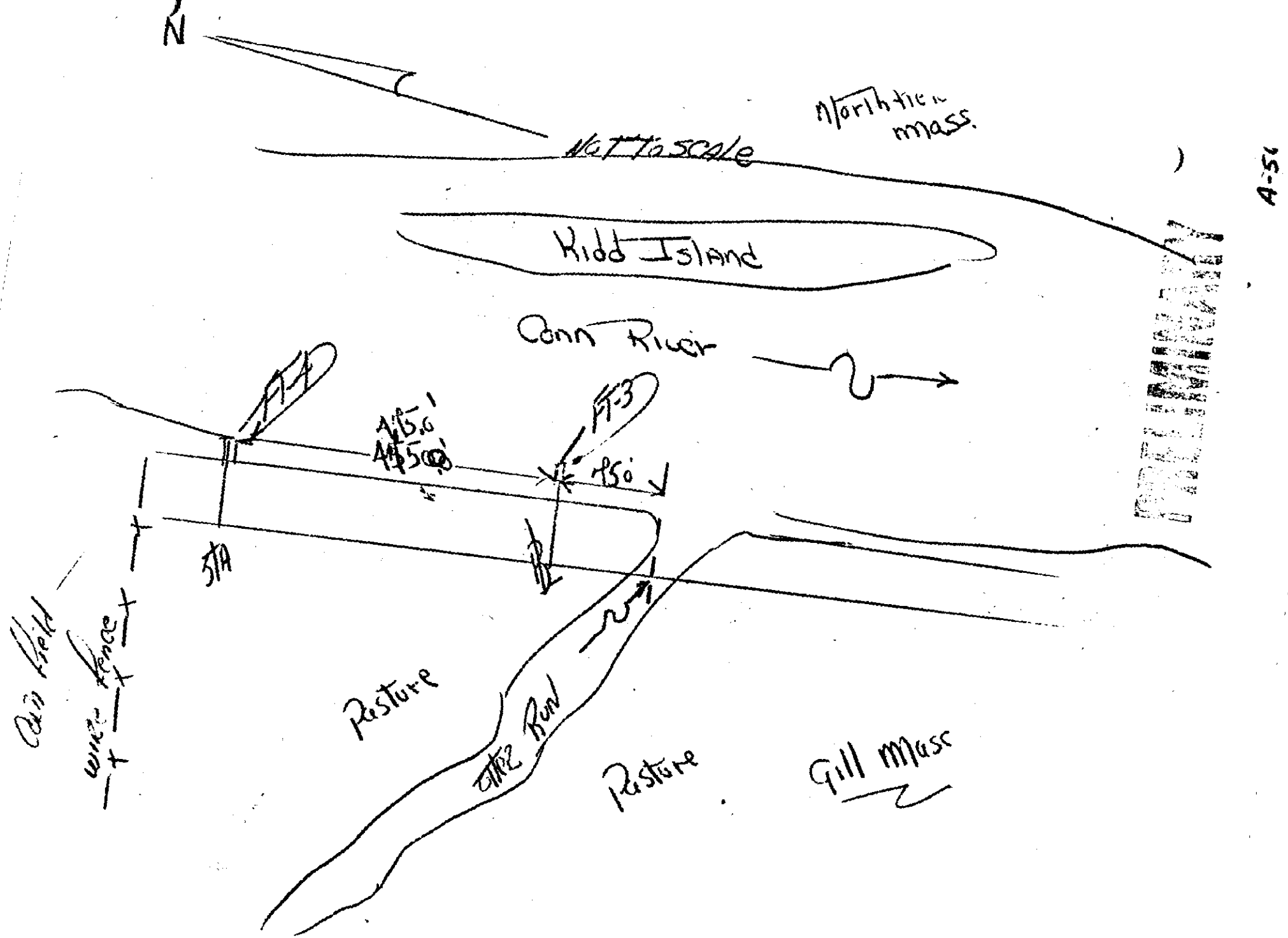
WATER TABLE DEPTH _____

Remarks: [redacted]

Submitted by C. Couch

NED FORM 119

A-55


N
Not to scale
Northfield
mass.
Kidd Island
Conn River
FT-1
FT-3
455'
455'
455'
STA
Oat Field
wire fence
Pasture
Pasture
Gill Mass

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site [illegible] Page 1 of 1 Page

Boring No. [illegible] Desig. ______ Diam. (Casing) ______

Co-ordinates: N ______ E ______

Elevation Top of Boring ______ M.S.L.
Total Overburden Drilled [illegible] Feet
Elevation Top of Rock [illegible] M.S.L.
Total Rock Drilled [illegible] Feet
Elevation Bottom of Boring ______ M.S.L.
Total Depth of Boring 10.0 Feet
Core Recovered ______ % No. Boxes ______
Core Recovered ______ Ft : ______ Diam. ______ In.
Soil Samples 2 1/2 In. Diam. 1 No.
Soil Samples 2" In. Diam. [illegible] No. [illegible]

Hammer Wt. [illegible]
Hammer Drop [illegible]
Casing Left [illegible]
Boring Started [illegible]
Boring Completed [illegible]
Subsurface Water Data [illegible] Page [illegible]
Obs. Well [illegible]
Drilled By [illegible]
Mfg. Des. Drill [illegible]
Inspected By: [illegible]
Classification By:
Classification By: [illegible signature]

DEPTH	Ft.	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECV'Y	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0.1		S-1	2 1/2	0.0 0.1	1	Drove 2 1/2" ID x 5.0 Solid Sample Spoon from 0.0 to 5.0 & took Sample. Hole remained open & clean to 5.0	Topsoil w/grass roots
		S-2 2 of 2	2 1/2	0.1 to 5.0	5, 5, 8, 8		Brown fine Sandy (10-15) SILT (ML)
		S-3R					
5.0		S-4 2 of 2		5.0	A	Drove 2" ID x 5.0 Solid Sample Spoon from 5.0 to 10.0 & took Sample - Drilled Hole 0.0 to 10.0	Brown fine Sandy (11) SILT (ML)
		S-5R	2"	to 9.3	A, 5, [illegible]		
9.3 10.0		S-6	2"	9.3 10.0	3		Tan Silty fine SAND (SM)

GENERAL REMARKS: Boring located in field @ Edge of [illegible] Site 10+6 - 49.0 [illegible] of Survey [illegible]

A-57

FORM 58 (Test)
AR 73

Boring No. [illegible]

Site: Newbury VT Site Map

Boring No. FD-1

Page 2 of 2

DEPTH	CORE/SAMPLE NO.	CORE/SAMPLE SIZE	CORE/SAMPLE DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1"=2'						
	T-1 2d2	2"	10.0	5	drove 2" ID x 5.0 Solid Sample Spoon from 10.0 To 15.0 & Took sample — Jetted NX fc To 15.0	Tan Silty (47.4) fine SAND (SM)
			To	5		
	C-1 8d2		15.0	6		
15.0				4		
				10		
	C-2 20f2	2"	15.0	5	drove 2" ID x 5.0 Solid Sample Spoon from 15.0 To 20.0 Jetted NX fc over Spoon To 20.0 & Took Sample	
			To	4		
				8		
	T-2		20.0	12		
20.0				15		
	T-3 2d2	2"	20.0	7	drove 2" ID x 5.0 Solid Sample Spoon from 20.0 to 25.0 Jetted NX fc over Spoon to 25.0 & Took Sample —	Reddish Brown to Grey Brown Silty (42.3 fine SAND (SM)
			To	11		
				11		
	T-4 8d2		25.0	12		
25.0				15		
					Con ob Sheet #3	

A-58

Site: Com-Piver Erosion Study, Newbury Ct. Site #1 | Boring No. FD-1 | Page 3 of 7

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	T-13		25.0	12	Drove 2" SS x 5.0 Solid Sample Spoon from 25.0 to 30.0 & took Sample	Grey Brown Silty (9.8) Med to fine SAND (SP-SM)
	Core 2	2"	to	17		
	T-14			21		
27.8			27.8	29		
	T-15		28.0			Grey, Silty (9.7) M-f SAND (SP-SM)
30.0	T-16	2'	30.0	26		
	Bottom of Exploration @ 30.0 depth					

FD-1

A-59

Conn River Bridge

Site: Thurston Farm

Boring No: FD-1

SUBSURFACE WATER OBSERVATIONS

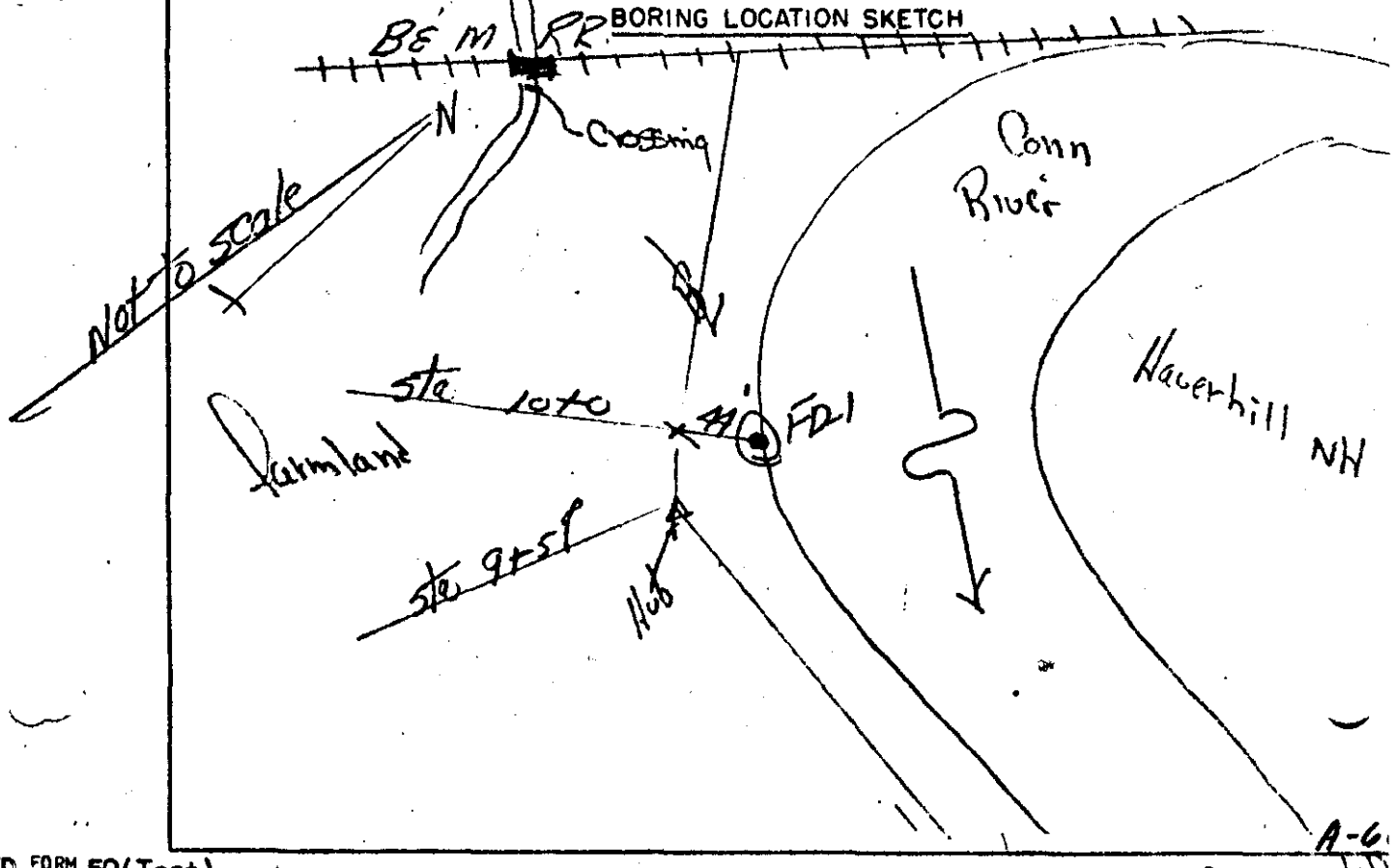
DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
6/23	1630	None	10.0	Dry		After Boring
6/24	1330	None	10.0	Dry		Before Boring
6/24	1600	35.0'	90.0	16.2		Before Boring

Thurston Farm

to Bradford ← Rte US #5 → To Wells River

Note: Depths are in feet below original ground. Water Level = 16.2'

BORING LOCATION SKETCH



NED FORM 50 (Test)

Boring No. FD-1

A-6

Connecticut River Erosion Study

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site St Johnsbury, Vt. Page 1 of 3 Pages

Boring No. FD-1 Desig. _____ Diam. (Casing) NXFC

Co-ordinates: N _____ E _____

Elevation Top of Boring _____ M.S.L.
Total Overburden Drilled 25.0 Feet
Elevation Top of Rock Unknown M.S.L.
Total Rock Drilled None Feet
Elevation Bottom of Boring _____ M.S.L.
Total Depth of Boring 25.0 Feet
Core Recovered _____ % No. Boxes _____
Core Recovered _____ Ft. _____ Diam. _____ In.
Soil Samples 2½" In. Diam. 9 No. _____
Soil Samples 2" In. Diam. 12 No. 1138

Hammer Wt. 350 Boring Started 6/29/56
Hammer Drop 18" Boring Completed 7/5/56
Casing Left 50-4" Subsurface Water Data 3 Page 3
Obs. Well 15.0'
Drilled By N.E. Winchester
Mfg. Des. Drill CPE 6
Inspected By: Lynch
Classification By: _____
Classification By: Anthony J. Jaffaldo

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0.5'	S-1	2½	0.0 0.5	2	drove 2½" ID x 5.0 Solid Sample Spoon from 0.0 to 5.0 & took Sample - Hole remained open & Clean to 5.0 -	Soil Grass & Roots
1.1	S-2	2½	0.5 1.1	5		Brown fine Sandy (30-40) SILT (ML) Roots
	SP 20+2	2½	To	8		Brown Silty (37.0) fine SAND (SM)
3.1	I-A 2		3.1	9		
A.A	I-5	2½	3.1 A.A			Brown fine Sandy (29.3) SILT (ML) (C=2166
5.0	I-6	2½	A.A 5.0	11		Grey to Brown fine Sandy (40.0) SILT (ML)
	I-1		5.0	10	drove 2" ID x 5.0 Solid Sample Spoon from 5.0 to 10.0 & took Sample - Setted NXFC from 0.0 to 10.0 -	
	20+2	2"	To	10		
	I-2			13		
			10.0	13		
10.0				13		

GENERAL REMARKS: Boring Located on East Bank of Conn River @ Sta 0+07 22' Rt of ℄ & 8.0 from Top Edge of Bank

A-61

Site #51 HANOVER NH. Conn River Erosion Study | Boring No. F-D-1 | Page 2 of 3

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	S-9	2"	10.0	6	drove 2" ID x 5.0' solid sample spoon from 10.0 to 15.0 & took sample - Jetted NXFC to 15.0	Brown Silty (12-20) fine SAND (SM)
	20%		To	9		
				10		
	S-10 R		15.0	9		
15.0				10		
	S-11	2"	15.0	5	drove 2" ID x 5.0' solid sample spoon from 15.0 to 20.0 Jetted NXFC over spoon To 20.0 & took sample only Rec. small amount 50%	
			P	1		
	S-12 R			6		
			20.0	12		
20.0				13		
	S-13	2"	20.0	10	drove 2" ID x 5.0' solid sample spoon from 20.0 to 25.0 - Jetted NXFC over spoon to 25.0 & took sample.	Brown Silty (5-9) m-f SAND (SP-SM)
	20%		To	14		
	S-14 R		24.6	14		
				17		
24.6				17		
25.0	S-15	2"	25.0			Brown Silty (12-15) fine SAND (SM)
	Bottom of Exploration @ 25.0 depth					

A-62

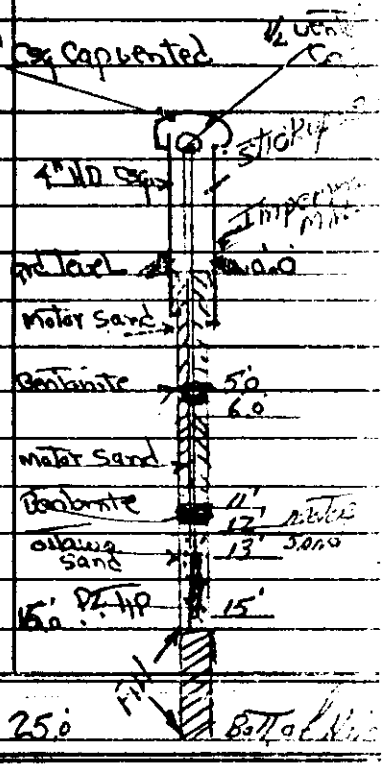
Conn River Erosion Study

Site: #51 Hanover NH.

Boring No: FD-1

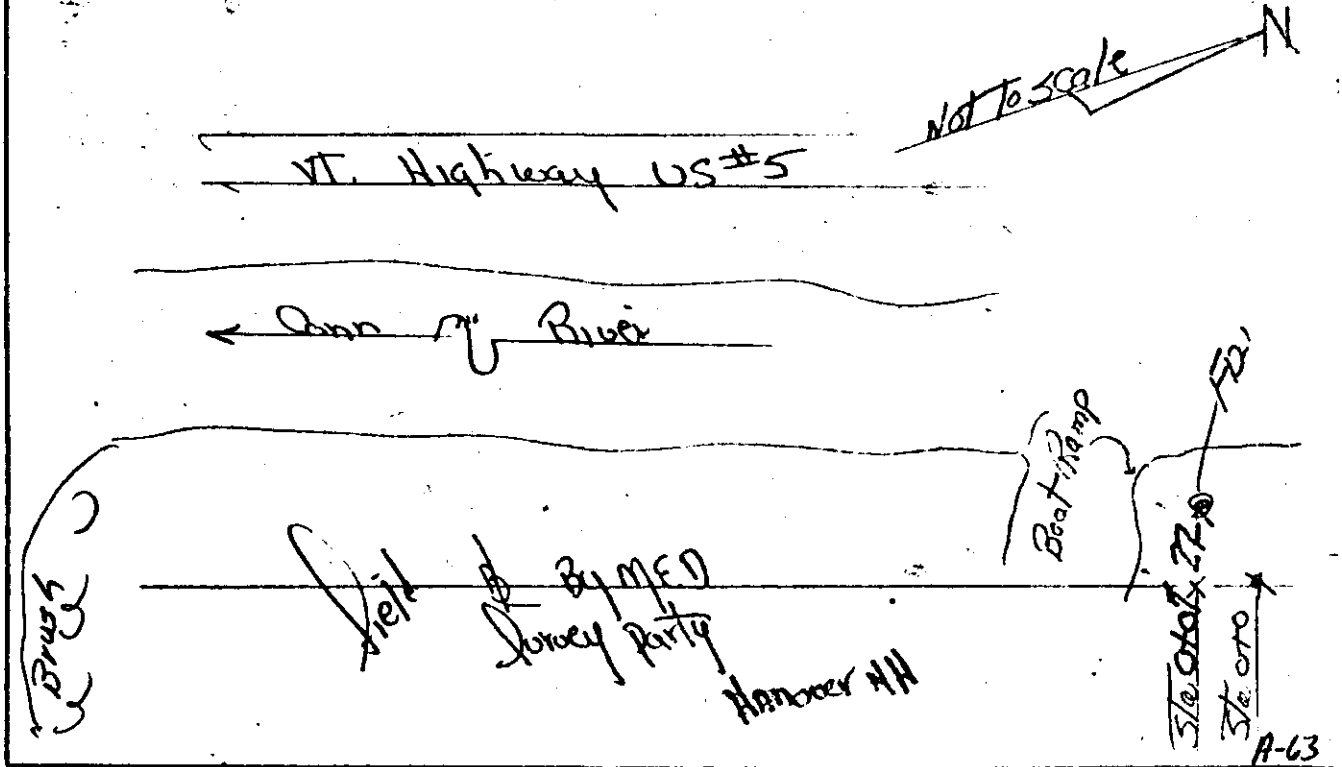
SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
6/28	1630	None	10.0	Dry		
6/29		Piezometer Set @	15.0'			
			Piezometer Set in Accordance To Test Sheet			



Note: Depths are in feet below original ground

BORING LOCATION SKETCH



FORM 50 (Test) NH-Hanover #10

Boring No. FD-1

WATER TABLE OBSERVATIONS

Site: Broad River Erosion Study #31 Hanover NH

Date of Reading: 6/25/76

Read by: Lynch

Piezometer #1

Hole No.	Gr'd. Elev.	Depth to water	Ground water elev.	Remarks
ED-1		9.7'		Pz. Tip Set @ 15.0 See Sketch on Log Sheet #3
				Reading Taken before leaving site well set for 24 hrs

NED FORM 174

A-64

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site #57 Windsor Mill Page 1 of 2 Pages

Boring No. SB-2 Desig. _____ Diam. (Casing) NX-C

Co-ordinates: N _____ E _____

Elevation Top of Boring _____ M.S.L.
Total Overburden Drilled 25.0' Feet
Elevation Top of Rock Unknown M.S.L.
Total Rock Drilled None Feet
Elevation Bottom of Boring _____ M.S.L.
Total Depth of Boring 25.0' Feet
Core Recovered — % No. Boxes —
Core Recovered _____ Ft. _____ Diam. ____ In.
Soil Samples 2 1/2 In. Diam. 6 No.
Soil Samples 2" In. Diam. 12 No. NX Classification By: Anthony J. Zappala

Hammer Wt. 350 Boring Started 6/30/76
Hammer Drop 18" Boring Completed 6/30/76
Casing Left 50' 4"
Subsurface Water Data 3 Page 3
Obs. Well 15.0'
Drilled By Art Winchester
Mfg. Des. Drill CP-6
Inspected By: C. Lynch
Classification By: _____

DEPTH		CORE/SAMPLE			BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	1" = 2'	NO.	SIZE	DEPTH RANGE			
0.4		S-1	2 1/2	0.0 0.4	3	drove 2 1/2" ID x 5.0' solid sample spoon from 0.0 to 5.0 & took sample - hole remained open & clean to 5.0' -	Topsoil & grass roots. Brown fine Sandy (SM-ML) Silt (ML) w/roots
1.1		S-2	2"	0.4 1.1			
		S-3	2 1/2				
		I-4		1.1	6		Grey/brown Si Ty (30-40) fine Sand (SM)
		20 ft	2 1/2"	10	6		
		I-5		5.0	12		
5.0'					11		
		I-6		5.0	6	drove 2" ID x 5.0' solid sample spoon from 5.0 to 10.0 & took sample. Jetted NX-C 0.0 to 10.0'	Grey Si Ty (SM) fine Sand (SM) G = 2.67
		20 ft	2"	10	7		
		I-7		10.0	9		
					10		
12.0					13		

GENERAL REMARKS: Boring Located on East Bank of Conn River @ Sta 0+07 14.0' Rt of ℄ & 16.0 from Edge of Bank

A-65

Site #31 Hancock NH. Conn River Erosion Study | Boring No. FD-2 | Page 2 of 3

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0 to 15.0	F-9 20 1/2	2"	10.0	6	drove 2" ID x 5.0 solid sample spoon from 10.0 to 15.0 & took sample - Jetted N x fc to 15.0	Same as J6
			10	10		
	F-9R			12		
			15.0	12		
15.0				12		
15.0 to 20.0	F-11 20 1/2	2"	15.0	7	drove 2" ID x 5.0 solid sample spoon from 15.0 to 20.0 & took sample - Jetted N x fc to 20.0	
			10	12		
				12		
	F-11R		20.0	13		
20.0				14		
20.0 to 25.0	F-12 20 1/2	2"	20.0	14	drove 2" ID x 5.0 solid sample spoon from 20.0 to 25.0 & took sample -	Grey to Brown, Silty S.F. to M-F. SAND (SM) & some Gravel.
			To	11		
				12		
	F-12R		25.0	14		
25.0				16		
	Bottom of Exploration @ 25.0 → depth					

End

Connecticut River Crossing Study

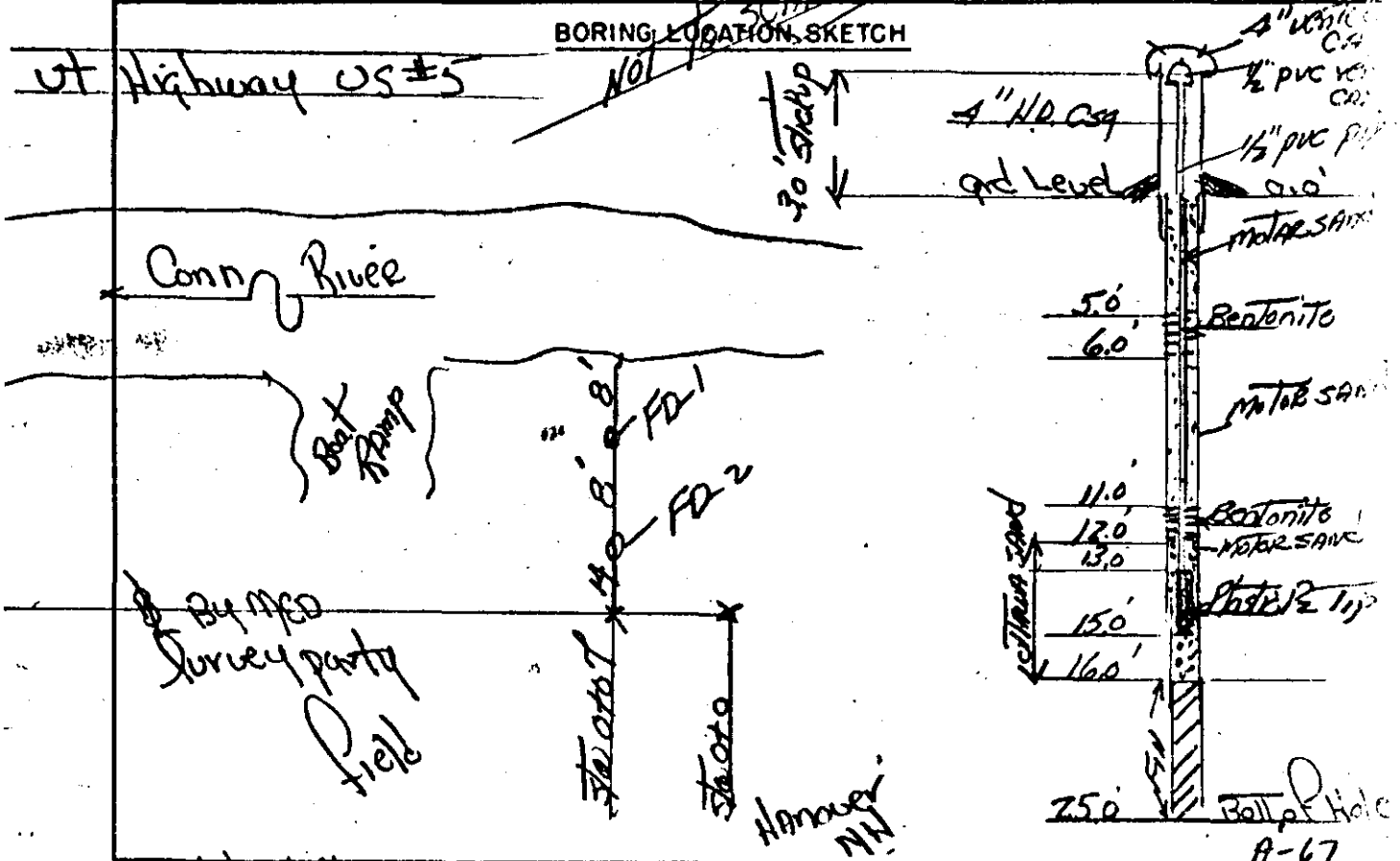
Site: #51 Hanover, NH
Boring No: FD-2

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
6/29	1630	None	10.0'	dry		
6/30		Piezometer set @ 15.0'				

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



59 (Test) NH Highway #10

Boring No. FD-2

WATER TABLE OBSERVATIONS

Ottauquechee River Erosion Study

Site: #51 Hanover, NH

Date of Reading: June 30, 1976

Read by: Lynch

Piezometer #2

Hole No.	Gr'd. Elev.	Depth to water	Ground water elev.	Remarks
FD-2		9.6		Pz tip set @ 15.0 see sketch on log sheet #3
				Reading Taken before leaving site - well set for 3 hrs

NED FORM JUN 48 174

U. S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site _____ Page 1 of 6 Pages

Boring No. FD-1 Desig. _____ Diam. (Casing) 4"HC

Co-ordinates: N _____ E _____

Elevation Top of Boring _____ M.S.L. | Hammer Wt. 350 | Boring Started 5/17/46
Total Overburden Drilled 10.0 Feet | Hammer Drop 18" | Boring Completed 5/18/46
Elevation Top of Rock unknown M.S.L. | Casing Left None
Total Rock Drilled None Feet | Subsurface Water Data 6 Page 6
Elevation Bottom of Boring _____ M.S.L. | Obs. Well None
Total Depth of Boring 10.0 Feet | Drilled By W.E. Winchester
Core Recovered ___ % No. Boxes ___ | Mfg. Des. Drill CR-6
Core Recovered ___ Ft. ___ Diam. ___ In. | Inspected By: Lynch & Winchester
Soil Samples 2½ In. Diam. 6 No. | Classification By:
Soil Samples 2 In. Diam. 1⅜ No. 1,B | Classification By: Anthony J. Jaffala

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0.5	J-1	2½	0.5	3	drove 2½" ID x 5.0 Solid Sample Spoon from 0.0 to 5.0 & took Sample - Hole open & clean to 5.0	Top Soil, Grass Roots
	J-2	20½	0.5 to 3.9	4		Brown fine Sandy (SM) SILT (ML) w/ roots
	J-3			6		
3.9	J-4	2½	3.9 to 5.0	9		
5.0	J-5			11		Grey Brown Silty (SM) m-f SAND (SP-SM) w/ hair roots
	J-6	20½	5.0 to 10.0	10	drove 2" ID x 5.0 Solid Sample Spoon from 5.0 to 10.0 & took Sample	Grey Brown Silty (SM) SAND (SP-SM) w/ Pieces of Gravel
		2"		9		
				12		
	J-7		10.0 to	17	Jetted 4"HC 0.0 to 10.0	
10.0				18		

GENERAL REMARKS: Boring Located on Rte 12 in Field @ East Edge of Conn River @ Station 5+29. 42' RT of ℄

Site: Conn. River Study, Cornish N.H. Site # 31 | Boring No. FD-1 | Page 2 of 6

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
11.2	J-8	2"	10.0 to 11.2	12	drove 2" ID x 5.0 Solid Sample Spoon from 10.0 - 15.0 & took Sample - Jetted NXFC to 15.0	Same as J 6
	J-9 2 of 2		11.2 to	11 11		Grey Brown Silty (11.7) M-f SAND (SP-SM)
	J-10	2"	15.0	14 16		
15.0						
	J-11 2 of 2	2"	15.0 to 20.0	9 20	drove 2" ID x 5.0 Solid Sample Spoon from 15.0 to 20.0 Jetted NXFC over Spoon to 20.0 & took Sample	Grey Brown Silty (9.5) M-f SAND (SP-SM)
	J-12		16.8	25		
16.8				21		
17.1	J-13	2"	18.8 17.1	21		Gray Brown Silty (17.1) Gravelly (26.5) SAND (SM)
20.0	J-14	2"	20.0			
	J-15 2 of 2	2"	20.0 to 25.0	9 11 15	drove 2" ID x 5.0 Solid Sample Spoon from 20.0 to 25.0 Jetted NXFC over Spoon to 25.0 & took Sample -	Brown fine Sandy (7.8) SILT (ML) 1/2" fine Sand Stratified
	J-16		25.0	17 19		
25.0	Cont on sub. Sheet #3					

A-70

Site: Saco River Study, Bartlett, N.H. Site #31

Boring No. F-D-1

Page 3 of 6

DEPTH	CORE/SAMPLE			BLOWS PER FT.	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'	NO.	SIZE	DEPTH RANGE	CORE RECVY		
	S-17	2"	25.0	12	drove 2" ID x 5.0 Solid Sample Spoon from 25.0 to 30.0 Jetted NXC over Spoon to 30.0 & took Sample	~~Brown Silty (SM)~~ ~~m-f Sand (SM)~~ Brown Silty (35-45) fine SAND (SM)
	2 of 2		30.0	19		
	S-18			25		
				13		
30.0				35		
	S-19		30.0	18	drove 2" ID x 5.0 Solid Sample Spoon from 30.0 to 35.0 Jetted NXC over spoon to 35.0 & took Sample	Brown Silty (38.5) m-f SAND (SM)
	2 of 2			19		
	S-20	2"		12		
			34.6	52		
34.6						
35.0	S-21	2"	34.6 35.0	37		Brown Silty (30-40) fine SAND (SM)
35.8	S-22	2"	35.0 35.8	16	drove 2" ID x 5.0 Solid Sample Spoon from 35.0 to 40.0 Jetted NXC over Spoon to 40.0 & took Sample	Grey Brown Silt (ML) w/ fine Sand Stratification
	S-23		35.8	23		
	2 of 2			25		
	TEAR	2"		39		
			40.0	49		
40.0						
	Continued				Sheet # 4	

A-71

Site: Conn. River Study Brush NH. Site #31	Boring No. FD-1	Page 1 of 6

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
1" = 2'						
	S25 col'd 2" to 46'	2"	40.0 to 45.0	26 36 11 18 62	drove 2" ID x 5.0 Solid Sample Spoon from 40.0 to 45.0 Jetted NX & Core Spoon from 40' to 45' & took Sample —	Grey Brown fine Sandy (22.3) SILT (ML)
45.0'						
46.0'	S26 col'd 2" to 46'	2"	45.0 to 46.0	18	drove 2" ID x 5.0 Solid Sample Spoon from 45.0 to 50.0 Jetted NX & Recover Spoon to 50.0 & took Sample —	Brown Silty (20-30) Fine SAND (SM)
	S29 col'd 2" to 50'	2"	46.0 to 50.0	22 31 40 30		Grey Brown Fine Sandy (15-20) SILT (ML)
50.0'						
	S31 col'd 2" to 55'	2"	50.0 to 55.0	8 11 21 31 26	drove 2" ID x 5.0 Solid Sample Spoon from 50.0 to 55.0 Jetted NX & Core Spoon to 55.0 & took Sample —	Brown Silty (23.9) Fine SAND (SM) G=
55.0'						
	Cont on sub Sheet #5					

Site: Conn River Study Cornish, NH. Site #31	Boring No. FD-1	Page 3 of 6

DEPTH	1"=2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
		J-33 2of2 J-34R	2"	55.0 To 60.0	5, 9, 19, 24, 26	drove 2" ID x 5.0 Solid Sample Spoon from 55.0 To 60.0 Jetted NX fc to 60.0 over Spoon & took Sample —	Same as J. 31
60.0		J-35 2of2 J-36R	2"	60.0 To 65.0	6, 10, 20, 29, 36	drove 2" ID x 5.0 Solid Sample Spoon from 60.0 to 65.0 Jetted NX fc over Spoon to 65.0 & took Sample —	
65.0		J-37 2of2 J-38R	2"	65.0 To 70.0	16, 23, 35, 38, 42	drove 2" ID x 5.0 Solid Sample Spoon from 65.0 to 70.0 & took Sample —	Brown Silty (40.1) fine SAND (SM)
70.0							

Bottom of Exploration @ 70.0 depth

Conn River Bridge Study

Site: 252 Cross Rd

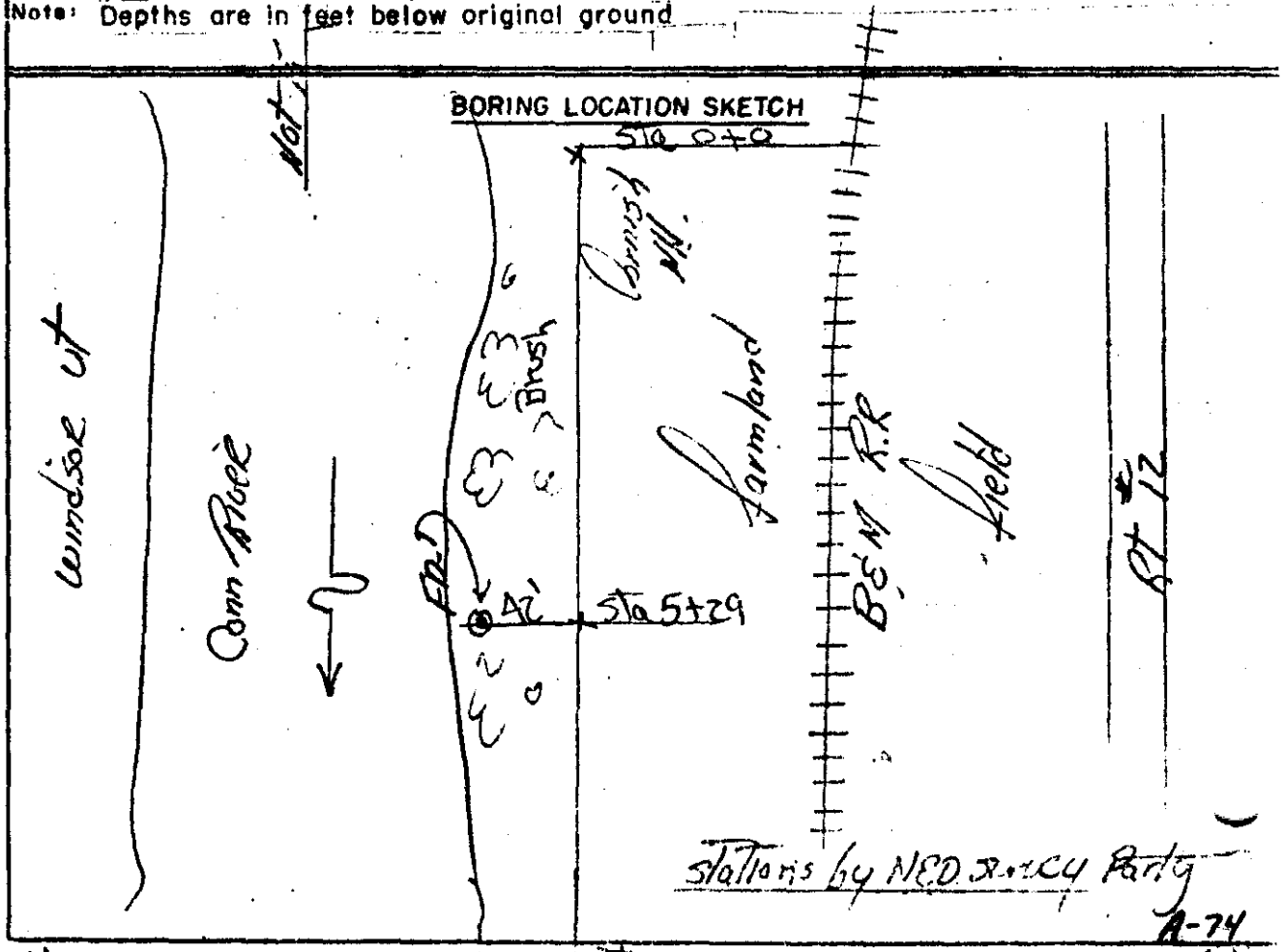
Boring No: ED-1

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
	Water Level = 44.1'					
6/21	0830	65.5	70.0	44.1'		Before pulling C

Note: Depths are in feet below original ground

BORING LOCATION SKETCH



FORM 69 (Test)

A-74

Boring No. 1

U.S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site _____ Page 1 of 4 Pages
Boring No. 1-1 Desig. _____ Diam. (Casing) NX-HC
Co-ordinates: N _____ E _____

Elevation Top of Boring _____ M.S.L.
Total Overburden Drilled 32.0' Feet
Elevation Top of Rock Unknown M.S.L.
Total Rock Drilled None Feet
Elevation Bottom of Boring _____ M.S.L.
Total Depth of Boring 32.0' Feet
Core Recovered — % No. Boxes —
Core Recovered — Ft. — Diam. — In.
Soil Samples 2 1/2 In. Diam. A No.
Soil Samples 2" In. Diam. 16 No. 1AB

Hammer Wt. 350 Boring Started 6/15/56
Hammer Drop 18 Boring Completed 6/15/56
Casing Left None
Subsurface Water Data 4 Page 4
Obs. Well _____
Drilled By C.E. Winchester
Mfg. Des. Drill CP-6
Inspected By: Lynch
Classification By: _____
Classification By: Anthony J. Zappala

DEPTH		CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	1"=2.0						
0.1'		S-1	2½	0.0 to 0.1'	3	drove 2½" ID x 5.0' Solid Sample Spoon from 0.0' to 5.0' & took Sample. Hole open & Clean to 5.0'	Topsoil w/Grass & Roots
		S-2	2½	0.1' to 5.0'	3		Light Brown Fine Sandy (16.6) Silt (ML) w/roots.
		Core			3		
		S-3R			3		
					3		
5.0'		S-4	2"	5.0 to 6.1'	3	drove 2" ID x 5.0' Solid Sample Spoon from 5.0' to 10.0' & took Sample. Jetted NX-HC 0.0 to 10.0'	
6.1		S-5R			3		Light Brown Fine Sandy (47.1) Silt (ML)
		S-6		6.1 to 10.0'	4		
		Core			4		
		S-7R			7		
10.0'					6		

GENERAL REMARKS: Boring Located in Hayfield approx. 12'± East Edge of Conn River 9.0' Left of ℄

Site: Connecticut River Erosion Study
Site #26 Charlestown, NH

Boring No. FD-1

Page 2 of 4

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
15.0'	S-8	2"	10.0	4	drove 2" ID x 5.0 solid sample spoon from 10.0 to 15.0 & took sample	Same as 6
	Core 2		10	4		
				4		
	C-9R		15.0	3		
				4		
20.0'	S-10	2"	15.0	3	drove 2" ID x 5.0 solid sample spoon from 15.0 to 20.0 & took sample - Jetted NXFC to 20.0 -	Brown Silty (37.0) fine SAND (SM) G = 2.72
	Core 2		15	3		
				3		
	C-11R		20.0	3		
				9		
25.0'	S-12	2"	20.0	10	drove 2" ID x 5.0 solid sample spoon from 20.0 to 25.0 & took sample - Jetted NXFC to 25.0 -	Brown Silty (43.0) fine SAND (SM)
	Core 2		20	12		
				16		
	C-13R		25.0	22		
				20		
	Cont on sub sheet #3					

Site [illegible]

Boring No. FD-1 of ____

DEPTH		CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
		S-14	2"		13	[illegible] 5.0 Split Sample Spoon from 25.0 to 30.0 ft	Brown Silty fine SAND (SM)
26.8		S-15			13		
		S-16		26.0	17	[illegible] Sample —	Grey Brown silty (26-28) Sandy (25-30) Gravel (GP-GM)
		S-17	2"		23		
				30.0	33		
30.0		Bottom of Exploration @ 30.0 [illegible]					

Site: [illegible]

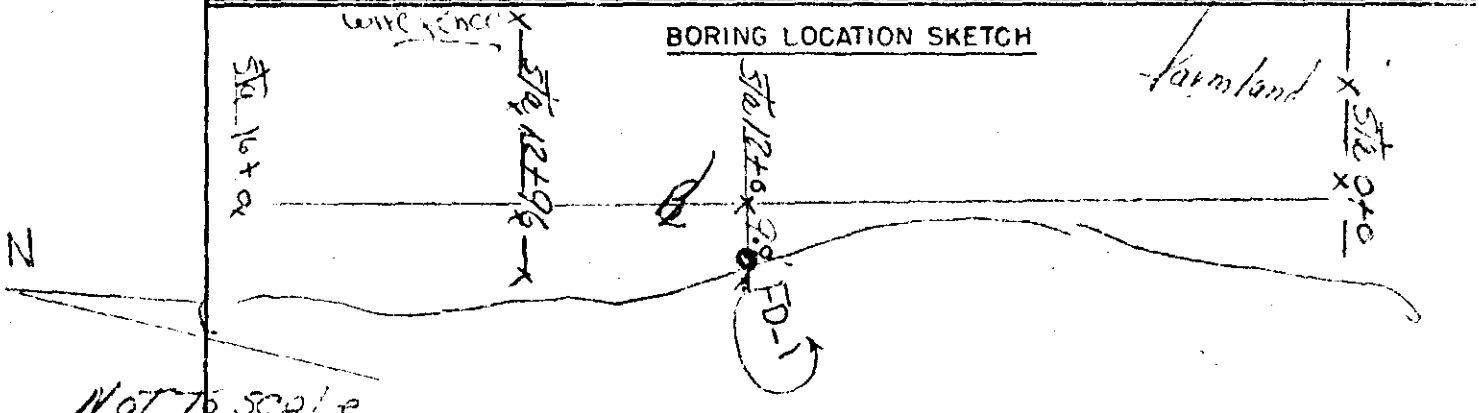
Boring No: FD-1

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
6/15/71	1100	25.0	30.0	16.1		1/2 hr. after drilling
						Dry

Note: Depths are in feet below original ground ... Water Level = 16.1'

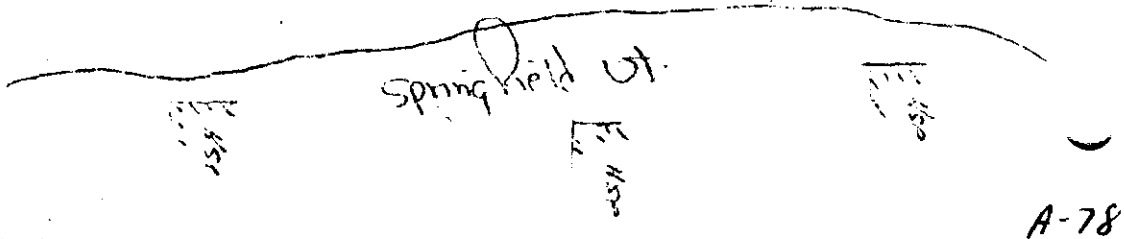
BORING LOCATION SKETCH



Not to scale

Conn River

Stations by NED Survey party



A-78

ED. FORM 52 (Test)

U.S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site _____ Page 1 of 2 Pages

Boring No. ED-1 Desig. _____ Diam. (Casing) 4"

Co-ordinates: N _____ E _____

Elevation Top of Boring _____ M.S.L. Hammer Wt. 300 Boring Started 4/[illegible]

Total Overburden Drilled 35.0' Feet Hammer Drop 30" Boring Completed [illegible]

Elevation Top of Rock Unknown M.S.L. Casing Left 35.0'

Total Rock Drilled _____ Feet Subsurface Water Data _____ Page _____

Elevation Bottom of Boring _____ M.S.L. Obs. Well _____

Total Depth of Boring 35.0' Feet Drilled By [illegible]

Core Recovered — % No. Boxes — Mfg. Des. Drill [illegible]

Core Recovered — Ft. — Diam. — In. Inspected By: [illegible]

Soil Samples 2½ In. Diam. 2" No. Classification By: [illegible]

Soil Samples 3" In. Diam. 3" No. 1 Classification By: [illegible]

DEPTH		CORE/SAMPLE			BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	1"=2'	NO.	SIZE	DEPTH RANGE			
0.6		S-1	2½	0.0 0.6	4	Drove 2½" ID x 5.0 Solid Sample Spoon from 0.6 to 5.0 E. took Sample. Hole open & clean To 5.0'	TOPSOIL Grass & Root.
		S-2		0.6	6		Brown fine Sandy (35-45) SILT (ML)
		20/12	2½	To	6		
		S-3R		5.0	6		
5.0					5		
		S-4		5.0	4	Drove 2" ID x 5.0' Solid Sample Spoon clean 5.0 to 10.0 E. took Sample. Split & mix E 0.0 To 10.0	Brown fine Sandy (39.3) SILT (ML)
		20/12	2"	To	4		
		S-5R			4		
9.1				9.1	4		
		S-6		9.1	9		Tan Silty (25-35) fine SAND (SM)
10.0		5"/18"	2"	10.0			

GENERAL REMARKS: Boring Located on East [illegible] of Bridge [illegible] 45° Left of [illegible]

A-79

Site: Conn River Erosion Study Site "9.0" Brimmerton CT.	Boring No. FD-1	Page 2 of 2

DEPTH	1"=	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
		J-8	2"	10.0 to 15.0	5	Drove 2" ID x 5.0 solid Sample Spoon from 10.0 to 15.0 & took Sample - Jetted NXFC to 15.0	Tan Silty (29.8) fine SAND (SM) G = 2.74
					6		
		J-9R			10		
					10		
					12		
15.0		J-10	2"	15.0 to 17.5	5	drove 2" ID x 5.0 solid Sample Spoon from 15.0 to 20.0 Jetted NXFC over Spoon to 20.0 & took Sample	
		J-11R			4		
17.5		J-12 2 of 2	2"	17.5 to 20.0	6		Brown fine Sandy (35-45) SILT (ML)
					10		
		J-13R			9		
20.0		J-14 2 of 2	2"	20.0 to 24.7	6	drove 2" ID x 5.0 solid Sample Spoon from 20.0 to 25.0 Jetted NXFC over Spoon to 25.0 & took Sample	Brown fine Sandy (18.7) SILT (ML) G = 2.75
					5		
					5		
		J-15R			4		
24.7		J-16	2"	24.7 to 25.0	8		Grey fine Sandy (35-45) SILT (ML)
25.0							

Cont on sub sheet #3

Site: Connecticut River Erosion Study
Site #90 M
Dummerston VT

Boring No. FD-1

Page 3 of 4

DEPTH	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	J-17		25.0	4	drove 2" ID x 5.0 Solid Sample Spoon from 25.0 to 30.0 Jetted NX FC over Spoon to 30.0 & Took Sample —	Same as J 16
	20/2	2"	to	5		
	J-18R		27.6	5		
27.6						Reddish Grey Brown Silty (5-12) Sandy (30-40) GRAVEL (GP-GM)
	J-19		27.6			
	20/2	2"	to	11		
			30.0	12		
30.0						Reddish Grey Brown Silty (11. Sandy (37.6) GRAVEL (GP-GM)
	J-20		30.0	29	drove 2" ID x 5.0 Solid Sample Spoon from 30.0 to 35.0 & Took Sample	
	20/2	2"	to	29		
			33.3	28		
33.3						Grey fine Sandy (25-35) SILT (ML)
	J-21		33.3	9		
	J-22R	2"	to			
35.0			35.0	13		
	Bottom of Exploration @ 35.0 depth					

A-81

Site: [illegible] UT

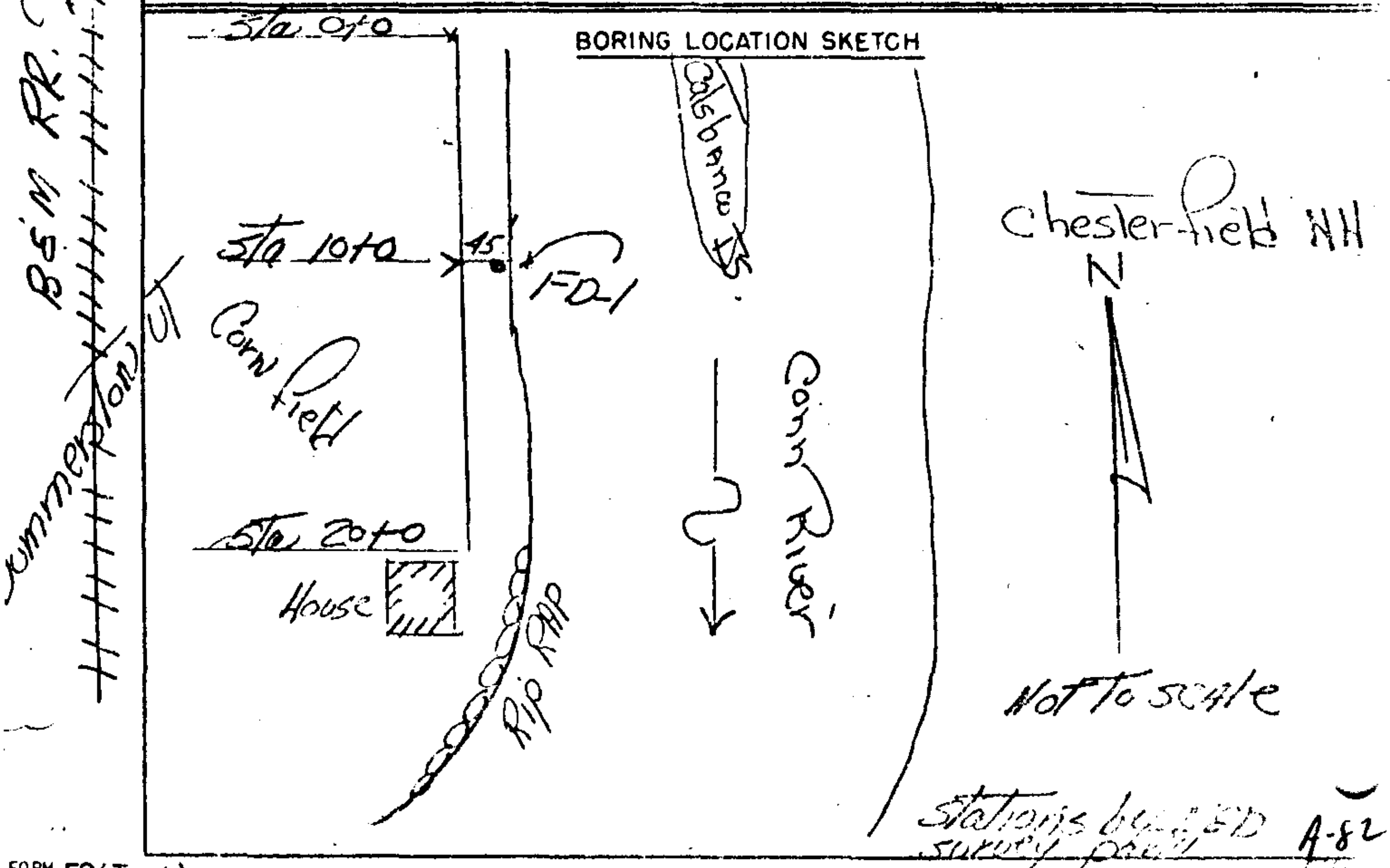
Boring No: FD-1

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
6/10	[illegible]	None	10.0	None		[illegible]
[illegible]	[illegible]	None	10.0	Dry		[illegible]
[illegible]	[illegible]	20.0	25.0	17.5		[illegible]
						[illegible]

Note: Depths are in feet below original ground ~~[illegible]~~ water = 19.0

BORING LOCATION SKETCH



U.S. ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FIELD LOG OF TEST BORING

Site [illegible] Page 1 of [illegible] Pages
Boring No. [illegible] Desig. ______ Diam. (Casing) [illegible]
Co-ordinates: N ______ E ______

Elevation Top of Boring ______ M.S.L.	Hammer Wt. 350	Boring Started [illegible]
Total Overburden Drilled 50.0' Feet	Hammer Drop 18"	Boring Completed [illegible]
Elevation Top of Rock Unknown M.S.L.	Casing Left None	
Total Rock Drilled None Feet	Subsurface Water Data ______ Page ______	
Elevation Bottom of Boring ______ M.S.L.	Obs. Well None	
Total Depth of Boring 50.0' Feet	Drilled By [illegible]	
Core Recovered — % No. Boxes —	Mfg. Des. Drill CP-6	
Core Recovered — Ft: — Diam. — In.	Inspected By: [illegible]	
Soil Samples 2½ In. Diam. 2 No.	Classification By:	
Soil Samples 2" In. Diam. 2? No. 2?8	Classification By: [signature]	

DEPTH	1"= 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
0.6		J-1	2½	0.0 0.6	3	drove 2½" ID x 5.0 solid sample spoon from 0.0 to 5.0' & took sample — hole open & clean to 5.0'	TOP SOIL Grass & roots
		J-2		0.6	3		Brown fine Sandy (212.6) SILT (ML) w/roots
		2½	2½	To	3		
		J-3B		4.1	2		
4.1		J-4B	2½	4.1	4		Grey Brown Silty (24.1) fine SAND (SM)
5.0		J-5B		5.0			
5.6		J-6	2"	5.0 5.6	3	drove 2" ID x 5.0' solid sample spoon from 5.0 to 10.0 & took sample — drilled hole from 0.0 to 10.0'	(56)
		J-7		5.6	4		Brown fine Sandy (36.5) SILT (ML) Stratified
		2"	2"	To	5		
		J-8		9.3	5		
9.3		J-9	2"	9.3 10.0	5		Grey Brown Silty fine SAND (SM)

GENERAL REMARKS: Boring located on the west bank of the [illegible] 47.0' south of the [illegible] line in the pasture.

A-83

Site: Conn River Erosion Study Site 135 Gill MASS | Boring No. FD-1 | Page 2 of 4

DEPTH	1" = 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
		T-10	2"	10.0 – 10	3	drove 2" ID x 5.0' solid sample spoon from 10.0' to 15.0' & took sample	Grey Brown Silty (45.4) fine SAND (SM)
		T-11R		2.1	3		
12.1		T-12	2"	12.1 – 13.4	4	Jetted NX to 15.0'	Brown fine Sandy (34.3) SILT (ML)
13.4				13.4	6		Grey Brown Silty (40.8) fine SAND (SM)
15.0		T-13	2"	15 – 15.0	1		
		T-14	2"	15.0 – 10	1	drove 2" ID x 5.0' solid sample spoon from 15.0' to 20.0' & took sample	
					3		
		T-15R		18.6	4	Jetted NX to 20.0'	
18.6		T-16	2"	18.6	4		Grey & Brown fine Sandy (34.5) SILT (ML) Stratified
19.8		T-17R		19.8	5		
20.0		T-18	2"	19.8 – 20.0			Grey Silty (20-30) fine SAND (SM)
		T-19	2"	20.0 – 15	4	drove 2" ID x 5.0' solid sample spoon from 20.0' to 25.0' & took sample	Grey Brown Silty (15.3) m-f. SAND (SM) G = 2.69
		20 1/2			10		
		T-20R		21.3	11	Jetted NX to 25.0'	
					12		
24.3							
24.6		S-21	2"	24.3 – 24.6	13		Grey SILT (ML)
25.0		S-22	2"	24.6 – 25.0			Grey Brown Silty (5-12) Gravelly (10-15) SAND SP-(SM)

Cont on sub sheet #3

Site (?) River Erosion Study Site #235 Gibb MASS	Boring No. FD-1	Page __ of 2

DEPTH	1" = 2'	CORE/SAMPLE NO.	SIZE	DEPTH RANGE	BLOWS PER FT. / CORE REC'VY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
		J-23 (Roll 2)	2"	23.0 – 28.8	7 / 10 / 8 / 8	Drove 2" ID x 5.0' Solid-sample spoon from 25.0 to 30.0 & took sample —	Grey Brown Silty (6.0) Gravelly (16.3) SAND (SP-SM)
28.8		J-23 (2) / J-23R	2"	28.8 – 30.0	8		Grey SILT (ML) w/ fine SAND LAMINATION
30.0		Bottom of				Exploration @ 30.0'	LL = 39.2 PL = 26.2 PI = 13.0

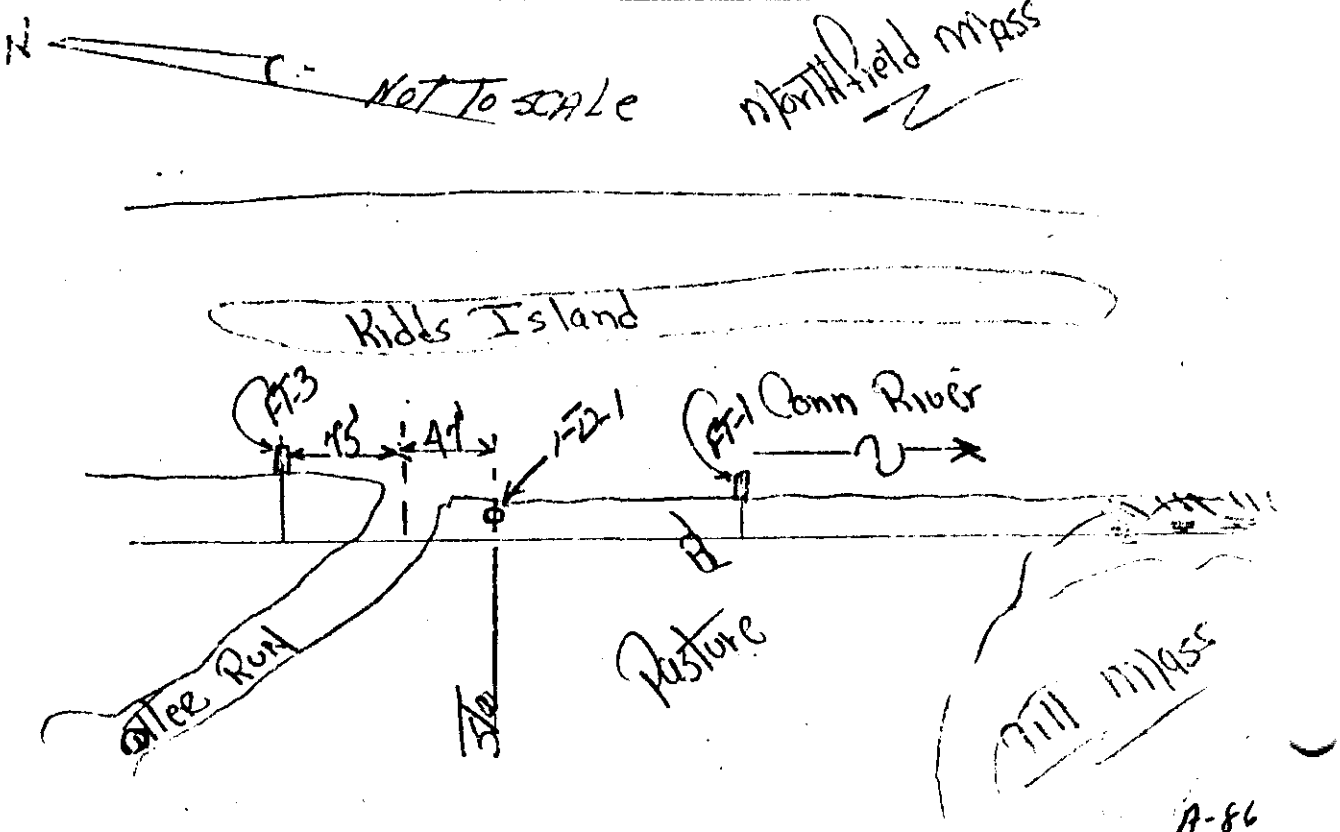
Site: Conn River Study Area 55
Boring No: FD-1

SUBSURFACE WATER OBSERVATIONS

DATE	TIME	DEPTH-BOT. OF CASING	DEPTH-BOT. OF BORING	DEPTH TO WATER	ELEVATION WATER	REMARKS
6/9	1215	35.0	32.0	17.5		after drilling

Note: Depths are in feet below original ground — Subsurface water = 17.5

BORING LOCATION SKETCH



A-86

FT-1

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

STA 11+10 40 RT 15

SITE #147

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

Conn. River Bank Erosion Studies

SITE Plainfield VT TYPE EXPLORATION Test Trench DATE 5/9/72

EXPLORATION NO. 1 / FT-1 CO-ORD. N _____ E _____ GROUND ELEV. _____

PURPOSE OF EXPLORATION To determine type of material in Bank Erosion

DEPTH, 1" = 4.0'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.1	J-1	0.0-0.1		Topsoil	dug w/ Hand shovel & pick step trench on slope from 0.0 To 13.5
		0.1		Brown silt (ML) w/trace of dry roots & fibers (M/w/ST)	
4.0		To			
	J-2				
8.0					
		11.5			
11.5					
12.0		11.5		Dry/silty fine (sand fm) roots & fibers (M/w/ST)	
13.5	J-3	13.5			Rock Level
16.0	Bottom of Exploration @ 13.5				

PRELIMINARY

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS:
4"-6" Diam. No. _____ Vol. _____ Cu. Ft
6"-18" Diam. No. _____ Vol. _____ Cu. Ft
Over 18" No. _____ Vol. _____ Cu. Ft

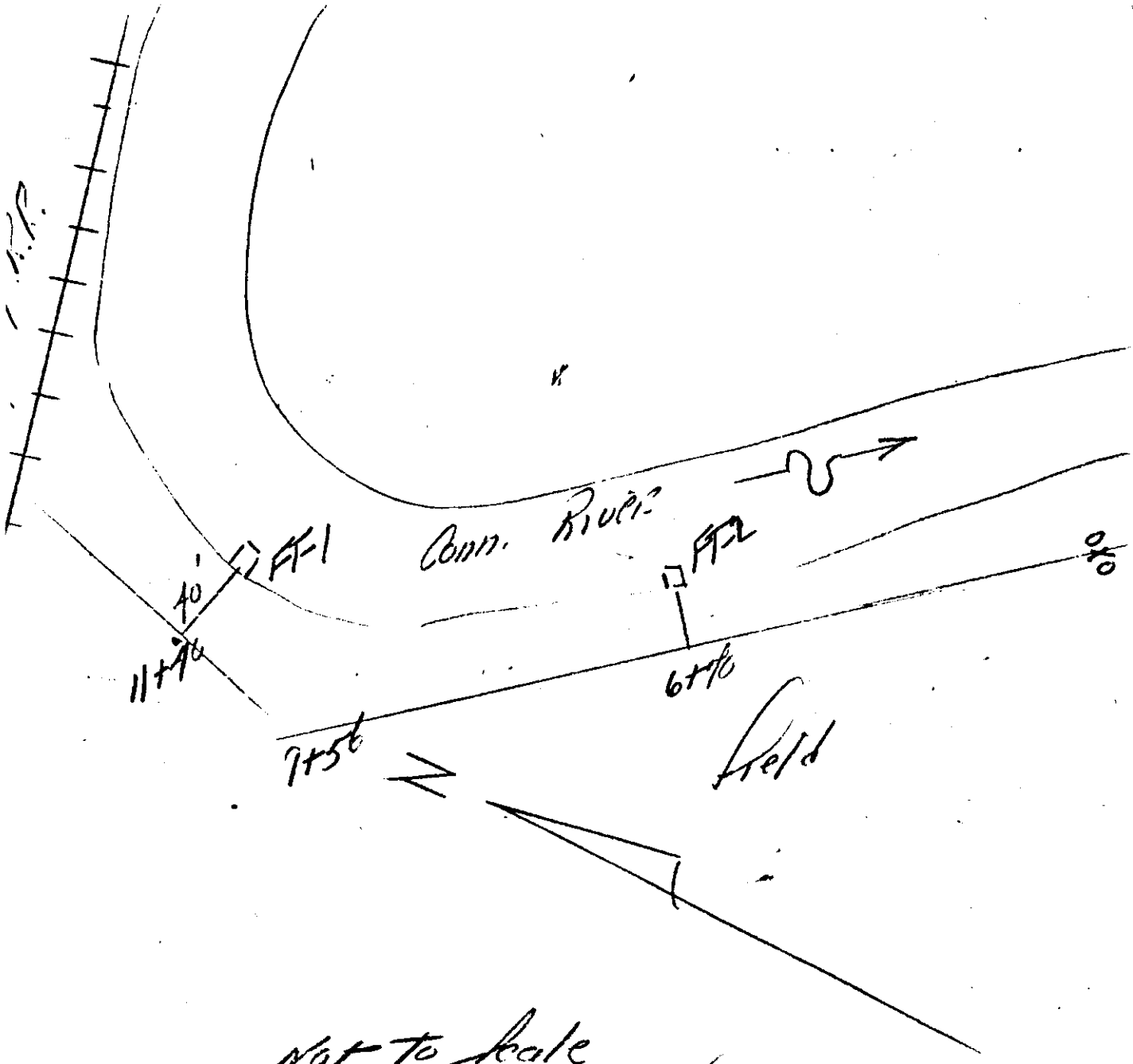
WATER TABLE DEPTH _____

Remarks: _____

Submitted by C Finch

NED FORM DEC 63 119 REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

A-87



Not to scale
Stations by NED survey party

PRELIMINARY

A-88

FT-2

CORPS OF ENGINEERS
NEW ENGLAND DIVISION
FOUNDATIONS & MATERIAL BRANCH

TH 6+70 To 7+20

FIELD LOG OF FOUNDATION AND BORROW INVESTIGATION

Conn. River Bank Erosion Studies
SITE Newbury VT - Site #14 TYPE EXPLORATION Test Trench DATE 5/74
EXPLORATION NO. FT-2 CO-ORD. N _____ E _____ GROUND ELEV. _____
PURPOSE OF EXPLORATION To determine type of material in Bank Erosion

DEPTH 1"=10'	SAMPLE'S No.	SAMPLE'S Depth	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION	REMARKS AND FIELD TEST DATA
0.1	T-1	0-0.1		Topsoil	dug w/ Hand Auger & pick from 0.0 To 15.7 Steep Trench Slope
		0.1		Lt Brown Silt (ML) w/ Trace of Sand	
10	T-2	10			
		8.1		Moist	
8.1	T-3	8.1		Brown fine Sandy Silt (ML) Stratifications	
10.1		10.1			
12.0				Brown Silty fine Sand (SM)	
15.7				Bottom of Exploration @ River Level = 15.7'	

DIMENSIONS OF TEST PIT _____ VOL. REPRESENTED _____ CU. FT.

COBBLES & BOULDERS: 4"-6" Diam. No. _____ Vol. _____ Cu. Ft.
6"-18" Diam. No. _____ Vol. _____ Cu. Ft.
Over 18" No. _____ Vol. _____ Cu. Ft.

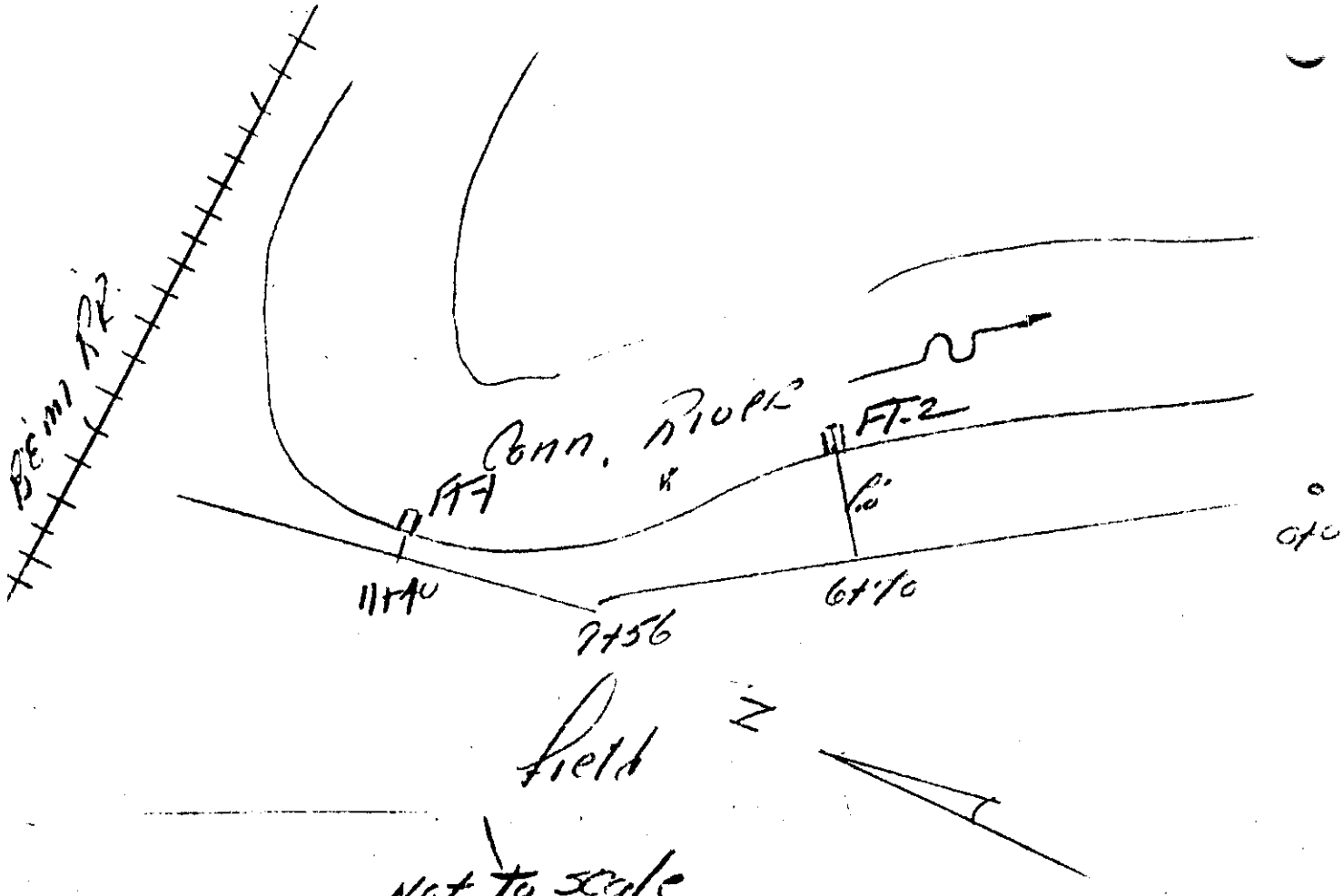
WATER TABLE DEPTH _____

Remarks: PRELIMINARY

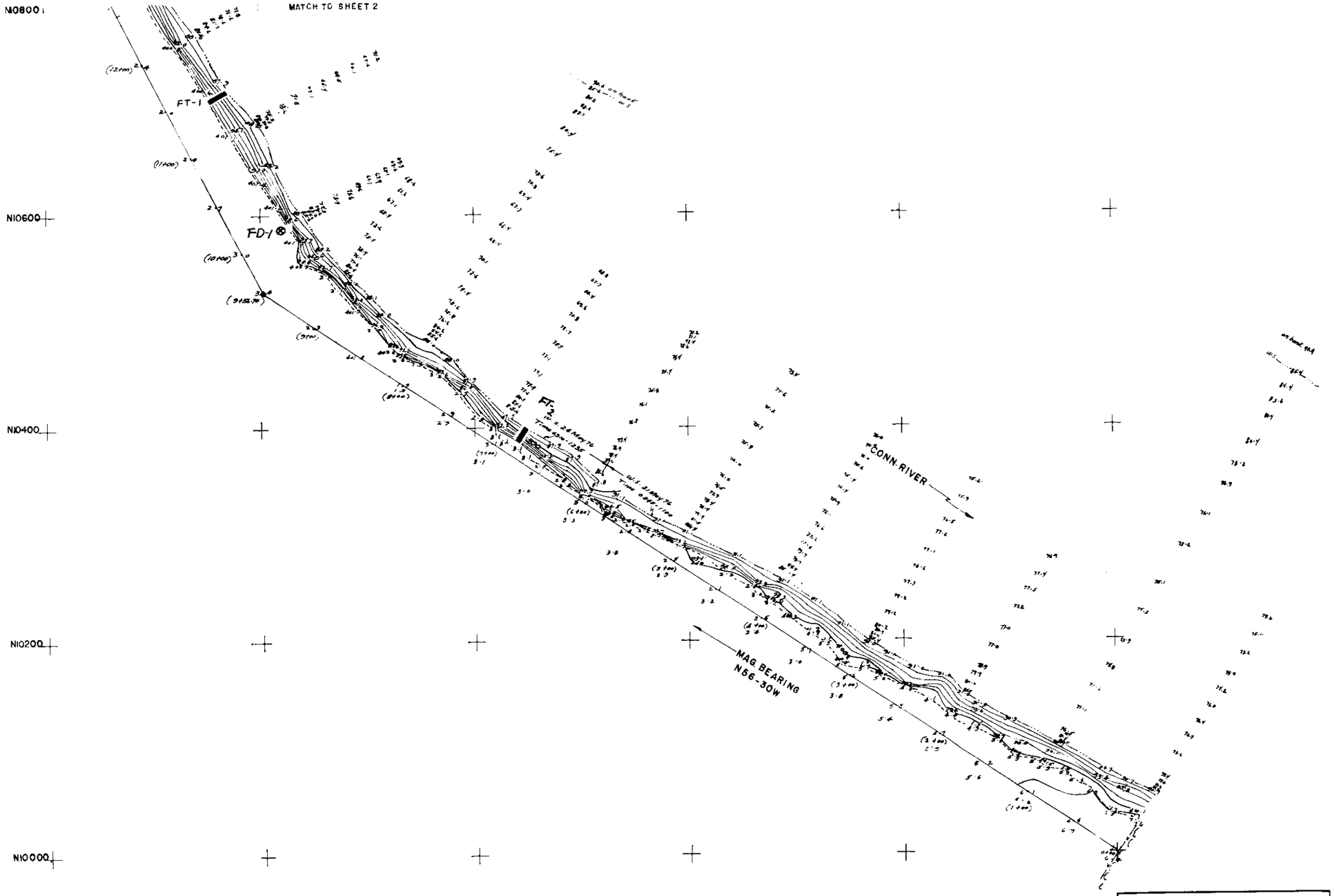
Submitted by C. Lynch

NED FORM DEC 63 19 REPLACES EDITION OF AUG 47 WHICH MAY BE USED UNTIL EXHAUSTED

A-89



PRELIMINARY



SURVEY RECORD

TITLE: CONN. RIVER, BANK EROSION

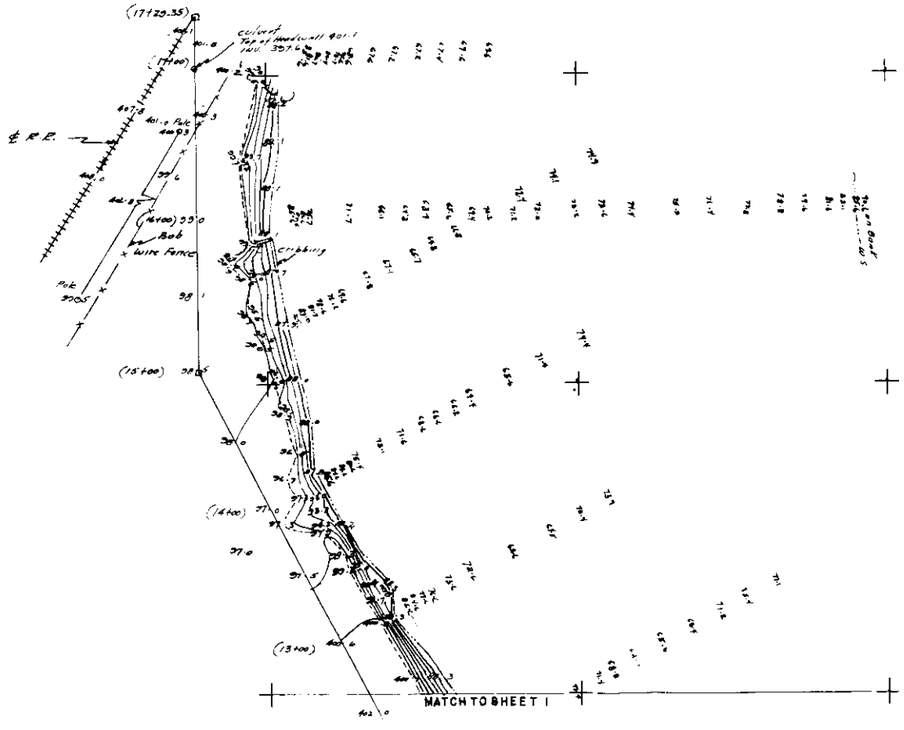
LOCATION: NEWBURY, VERMONT

DATUM: M.S.L.	CONTOUR INTERVAL 2'
SCALE:	DATE: MAY 1976
REF. BK. FC-361 & FC-363	PARTY: CAMPBELL
DWG. NO.	SHEET NO. 1

A-31

N11400

N11200



N11000

N10800

E8800 E9000 E9200 E9400 E9600 E9800

SURVEY RECORD

TITLE: CONN RIVER, BANK EROSION

LOCATION: NEWBURY, VERMONT

DATUM: M.S.L.	CONTOUR INTERVAL 2'
SCALE:	DATE: MAY 1976
REF. BK. FC-361-368	PARTY: CAMPBELL
DWG. NO.	SHEET NO. 2

MATCH TO SHEET 2

CONN. RIVER

Water Surface
May 26, 1976
Time 0830-0945

Water Surface
May 23, 1976
Time 1245-1500

FT-1

FT-2

FD-1

FD-2

MAG. BEARING
S 77-00 W

Water surface for 3dy 23 June 76
Elev. 865
Assumed Elev 100'

A-93

SURVEY RECORD

TITLE: CONN. RIVER, BANK EROSION, AREA 5I

LOCATION: HANOVER, N.H.

DATUM: ASSUMED — CONTOUR INTERVAL 2'

SCALE: — DATE: MAY 1976

REF. BK. FC-361 FC-363 — PARTY: CAMPIGLIO

DWG. NO. — SHEET NO. 1

96.6 on Bank
83 on S

83.5

78.5

76.7

69.3

63.5

69.2

69.2

69.6

65.0

69.1

69.2

67.5

62

76.6

80.7

MATCH TO SHEET 1

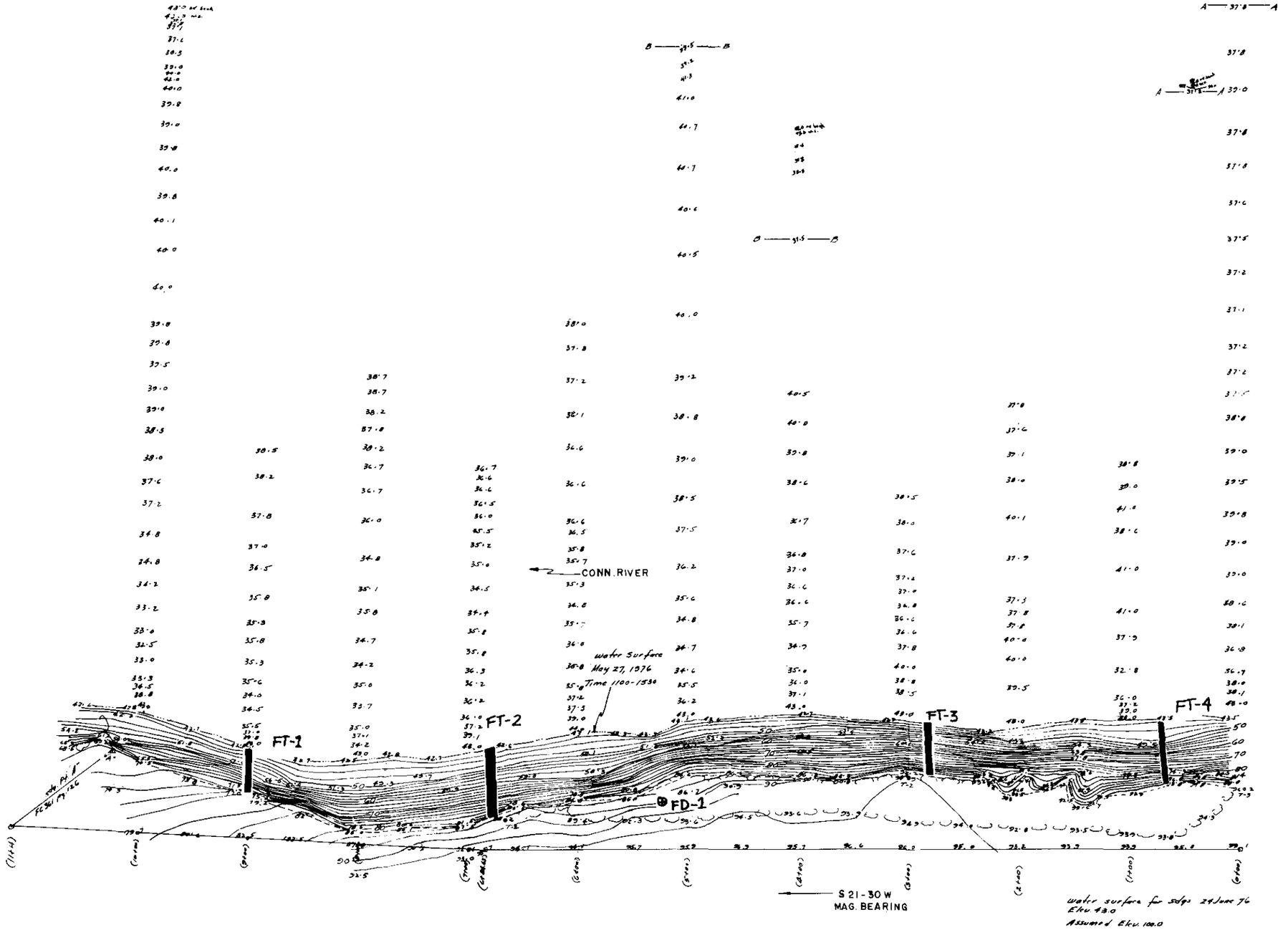
A-94

SURVEY RECORD

TITLE: CONN. RIVER, BANK EROSION, SI

LOCATION: HANOVER, N.H.

DATUM: ASSUMED	CONTOUR INTERVAL 2'
SCALE:	DATE: JUNE 1976
REF. BK. FC-361-363	PARTY: CAMP 18, L 10
DWG. NO.	SHEET NO. 2



SURVEY RECORD

TITLE: CONN. RIVER, BANK EROSION FCH31

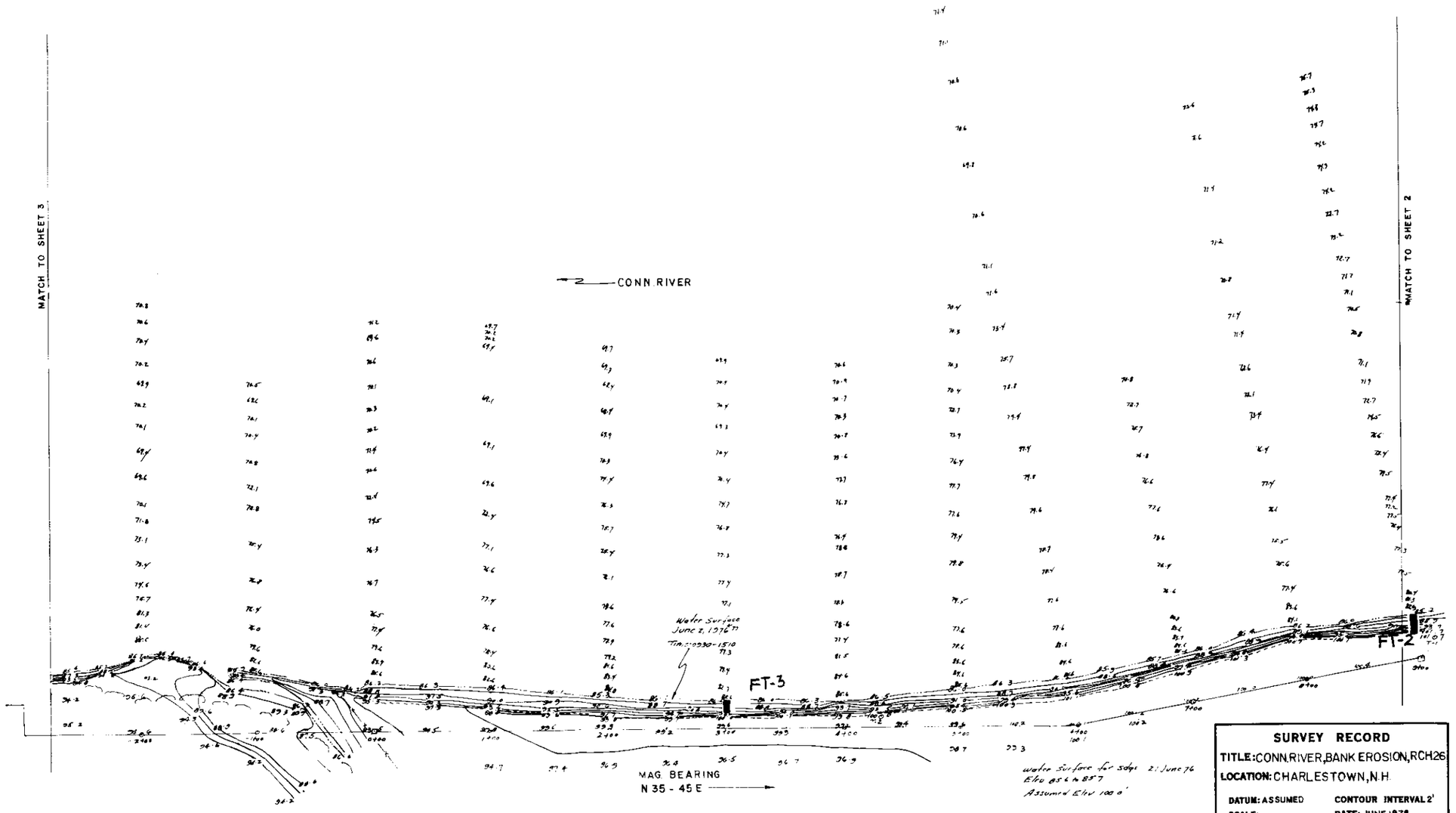
LOCATION: CORNISH, N.H.

DATUM: ASSUMED	CONTOUR INTERVAL 2'
SCALE:	DATE: MAY 1976
REF. BK. FC-361 FC 363	PARTY: CAMPBELL
DWG. NO.	SHEET NO. 1

A-95

MATCH TO SHEET 3

CONN. RIVER



MATCH TO SHEET 2

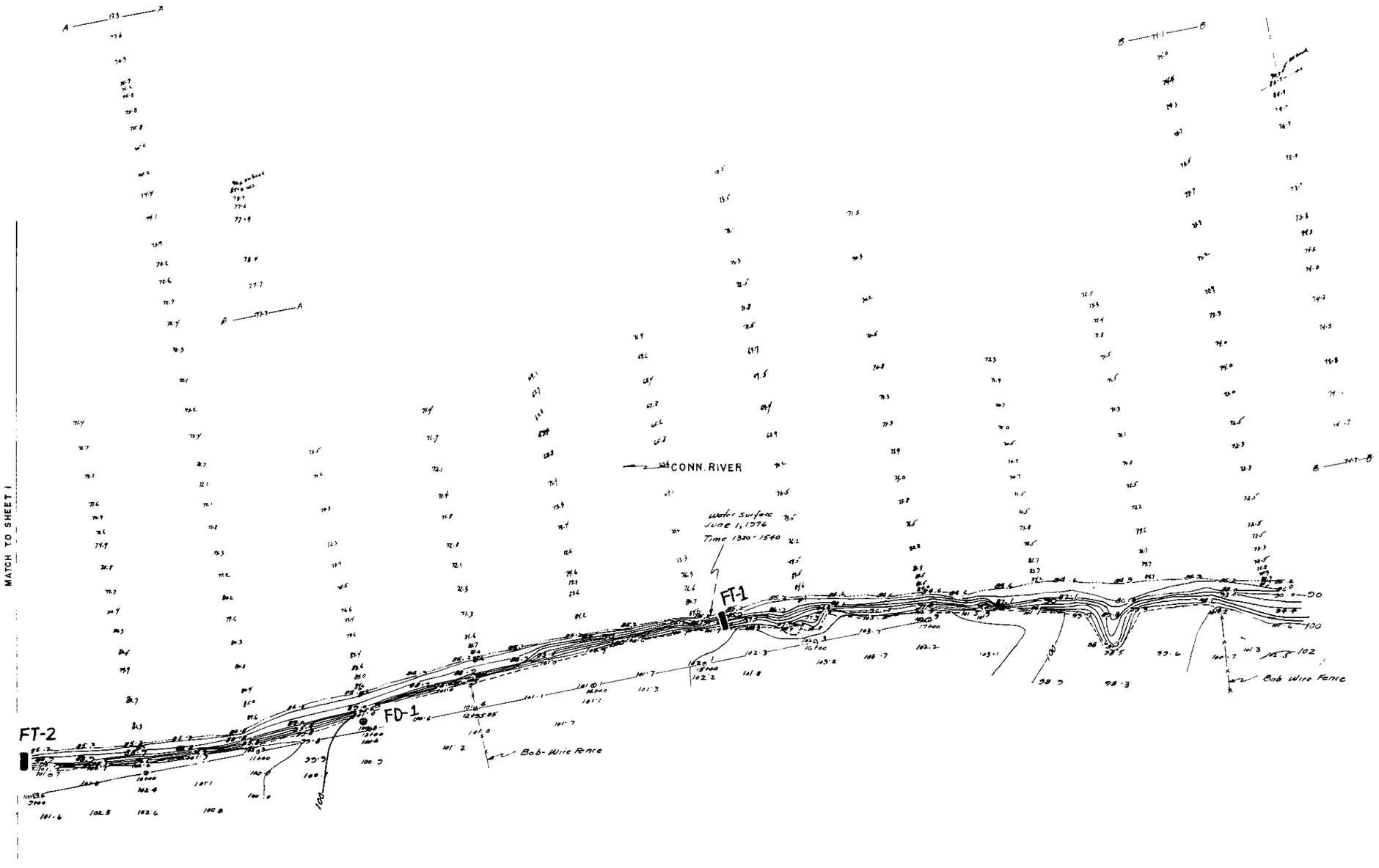
A-96

SURVEY RECORD

TITLE: CONN. RIVER, BANK EROSION, RCH 26

LOCATION: CHARLESTOWN, N.H.

DATUM: ASSUMED	**CONTOUR INTERVAL** 2'
SCALE:	**DATE:** JUNE 1976
REF. BK. FC-361-363	**PARTY:** CAMPIGLIO
DWG. NO.	**SHEET NO.** 1



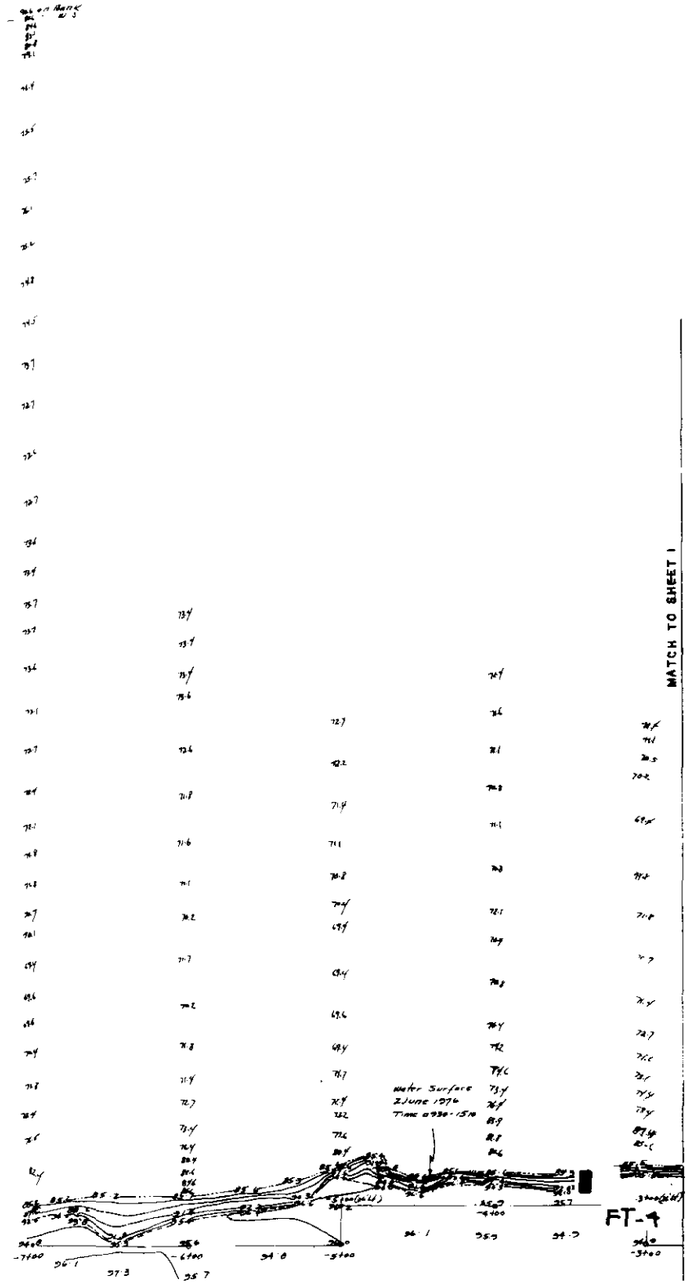
SURVEY RECORD

TITLE: CONN RIVER, BANK EROSION, RCH 26

LOCATION: CHARLESTOWN, N.H

DATUM: ASSUMED	CONTOUR INTERVAL 2'
SCALE:	DATE: JUNE 1976
REF. BK. FC-361-363	PARTY: CAMPIGLIO
DWG. NO.	SHEET NO. 2

A-97



SURVEY RECORD

TITLE: CONN. RIVER, BANK EROSION, RCH 26

LOCATION: CHARLESTOWN, N.H.

DATUM: ASSUMED	CONTOUR INTERVAL 2'
SCALE:	DATE: JUNE 1976
REF. BK. FC-361-363	PARTY: CAMPIGLIO
DWG. NO.	SHEET NO. 3

A-98

ISLAND

CONN. RIVER

Water Surface
@ June 1976
Time 1230 - 1600

FT-4

FT-3

FD-1

JG

CORN FIELD

MATCH TO SHEET 2

MAG BEARING S16-15W

SURVEY RECORD

TITLE: CONN. RIVER, BANK EROSION, 90A

LOCATION: DUMMERSTON, VT.

DATUM: ASSUMED	CONTOUR INTERVAL 2'
SCALE:	DATE: JUNE 1976
REF. BK. FC-361-363	PARTY: CAMPIGLIO
DWG. NO.	SHEET NO. 1

A-99

MATCH TO SHEET I

Water Surface
8 June 1976
Time 0800 - 1200

FT-2

FT-1

CORN FIELD

Water Surface for Slope June 76
Elev 770.777
Assumed Elev 100.0

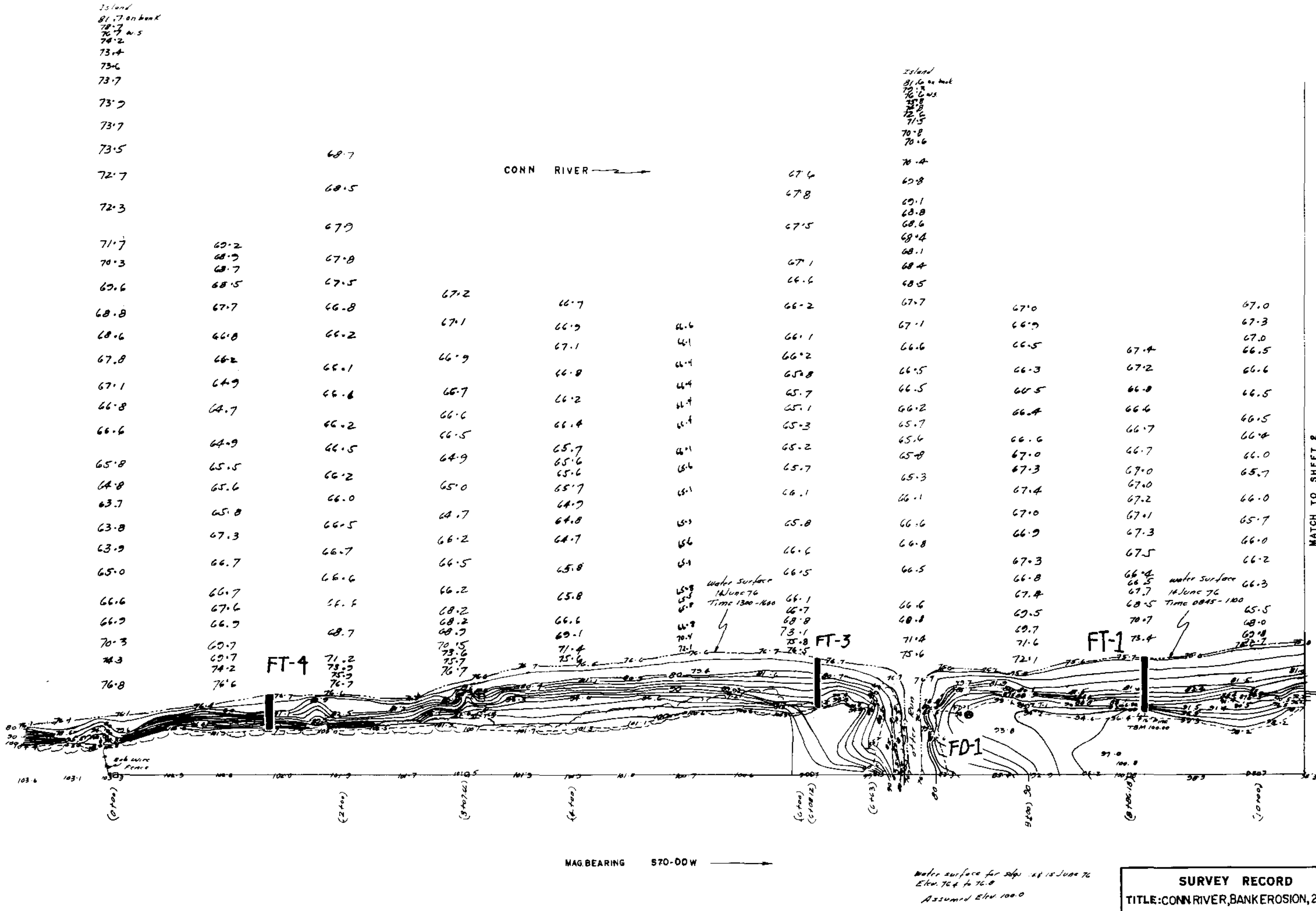
A-100

SURVEY RECORD

TITLE: CONN RIVER, BANK EROSION, 90A

LOCATION: DUMMERSTON, VT.

DATUM: ASSUMED	CONTOUR INTERVAL 2'
SCALE:	DATE: JUNE 1976
REF. BK. FC-361-363	PARTY: CAMP16L10
DWG. NO.	SHEET NO. 2



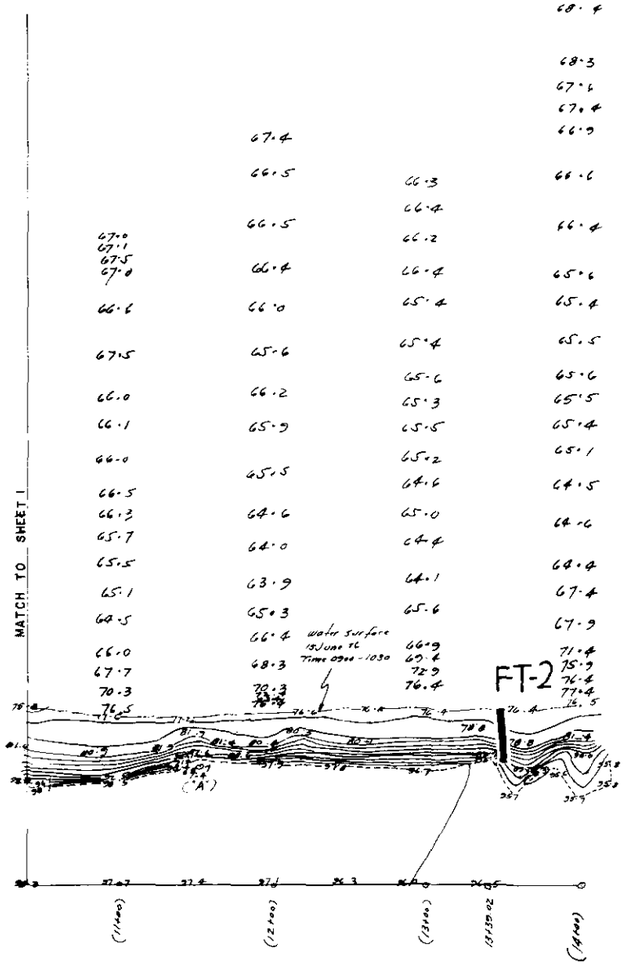
R-101

SURVEY RECORD

TITLE: CONN RIVER, BANK EROSION, 255

LOCATION: GILL, MASS

DATUM: ASSUMED	CONTOUR INTERVAL 2'
SCALE:	DATE: JUNE 1976
REF. BK. FC-361-363	PARTY: CAMPIGLIO
DWG. NO.	SHEET NO. 1

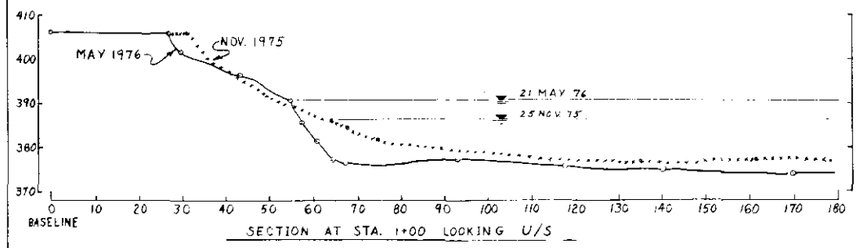


SURVEY RECORD

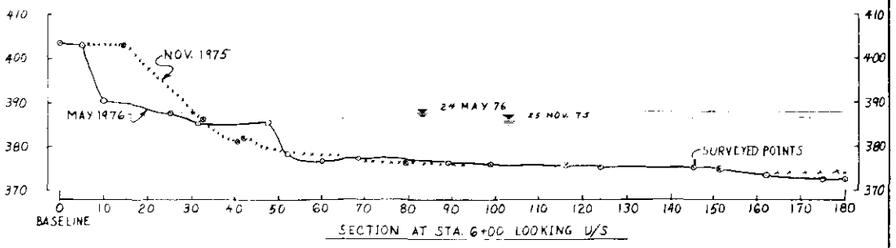
TITLE: CONN RIVER BANK EROSION 255

LOCATION: GILL, MASS.

DATUM: ASSUMED	CONTOUR INTERVAL 2'
SCALE:	DATE: JUNE 1976
REF. BK. FC-361-363	PARTY: CAMPIGLIO
DWG. NO.	SHEET NO. 2

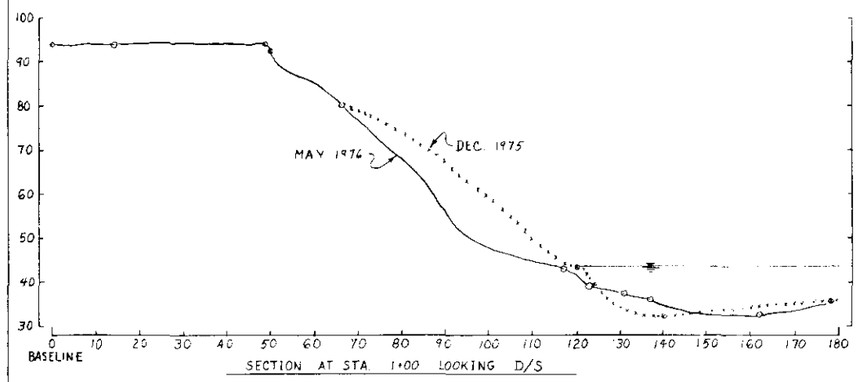


SECTION AT STA. 1+00 LOOKING U/S

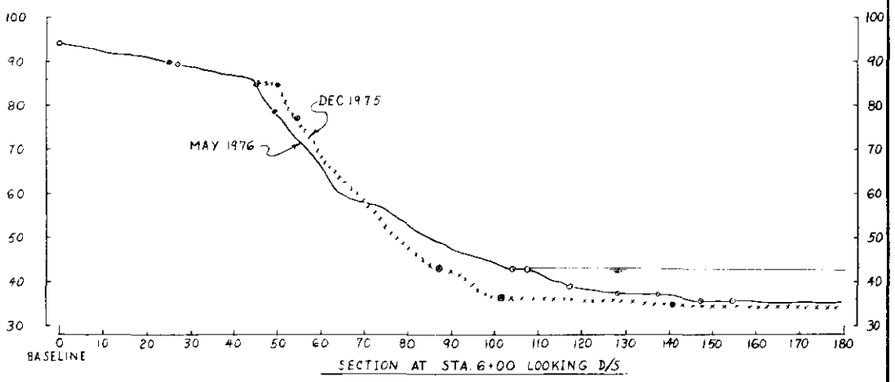


SECTION AT STA. 6+00 LOOKING U/S

AREA 147

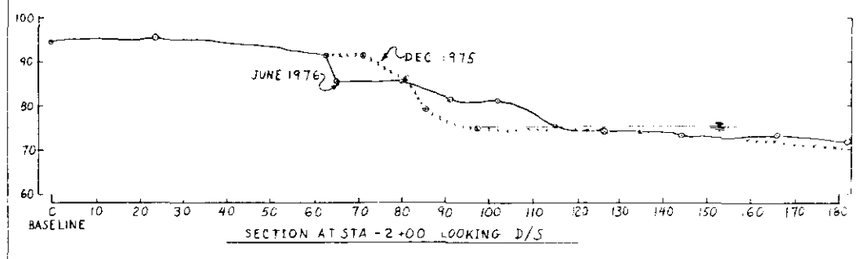


SECTION AT STA. 1+00 LOOKING D/S

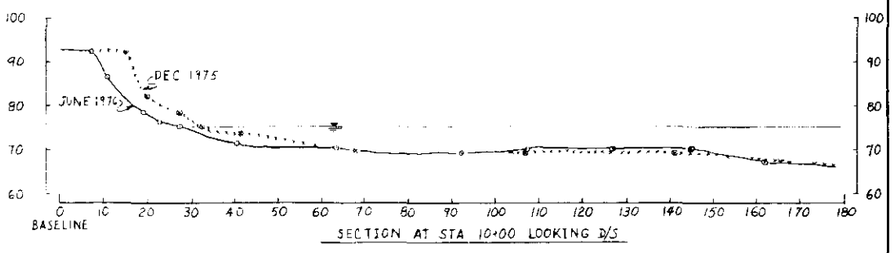


SECTION AT STA. 6+00 LOOKING D/S

AREA 31



SECTION AT STA -2+00 LOOKING D/S



SECTION AT STA 10+00 LOOKING D/S

AREA 26

PRELIMINARY

SCALE
-10 0 10 20

CONNECTICUT RIVER STREAMBANK EROSION STUDY
MASSACHUSETTS, NEW HAMPSHIRE, VERMONT

TYPICAL CROSS-SECTIONS

AREA 147: NEWBURY, VERMONT
AREA 31: CORNISH, NEW HAMPSHIRE
AREA 26: CHARLESTOWN, NEW HAMPSHIRE

A-103

APPENDIX B

CORPS OF ENGINEERS - NEW ENGLAND

STREAMBANK EROSION DEMONSTRATION PROJECTS (SECTION 32)

MONITORING OF EXISTING PROJECTS

General - Most of the streambank in New England is in private ownership and although erosion is extensive, bank protection works are not plentiful. There are many sporadic attempts to protect short reaches of bank but there are few well thought out and executed protective works. The Corps has constructed several small revetment projects, but generally these have been built strictly to established standards for rock revetments and do not warrant monitoring under Section 32.

There are, however, two existing protective works and two more that are underway which the New England Division feels are worth monitoring. The two existing projects are interesting because they are inexpensively constructed and have apparently done the job with only minor problems. An in-depth analysis of these projects will permit us to determine other situations where similar techniques might be appropriate.

The two projects underway for which monitoring is recommended are somewhat of an experimental nature. The U. S. Soil Conservation Service is experimenting with vegetative bank stabilization in New Hampshire and a private electric utility is conducting a program principally of vegetative measures in an area in Massachusetts. Both of these areas give the Corps an opportunity to analyze and report on new techniques at a minimum of Federal Cost. Neither SCS nor the utility can be expected to provide the detailed analysis and reporting that would be provided under Section 32.

The, Guidelines for Monitoring Demonstrations of Sites, now in draft and being reviewed by OCE and the Section 32 Steering Committee, will provide the guidance for establishing monitoring procedures. Generally speaking, however, the intensity of monitoring will vary for the areas selected. For instance a cursory look at soil conditions and river velocities will probably suffice at an area which is protected by rubber tire revetments, on the other hand, much more sophisticated monitoring of an area consisting of two miles of rock revetment will be necessary. In the latter case we will want to know the cause of several localized failures in a revetment that otherwise seems to have uniform forces acting upon it.

SITE NO. 1 - HANOVER, NEW HAMPSHIRE

A 10,000 foot long reach of the east bank of the Connecticut River was reveted in 1954 by the New England Power Company (NEPCO). The revetment was done in conjunction with the reconstruction of Wilder Dam which is about 2 miles from the downstream limit of the revetment. The dam was reconstructed in the 1950's at a site about 3/4 mile downstream of the original site and the full operating pool was established 15 feet higher at elevation 385.

The property was then, and is now, owned by Dartmouth University. The University insisted that its bank be protected when it ceded flowage rights to NEPCO.

The subject area along with several other smaller reveted areas are mostly inaccessable by land. NEPCO built a small barge from old oil tanks, attached two outboard motors, and placed the revetments from the water. Gravel was loaded onto the barge along with a small dozer. The barge would move to the site and the dozer would push off the gravel bedding. A well graded rock was then placed on the bedding by the same method. Although NEPCO has not yet provided the Corps with job specifications the revetment seems to be what could be considered a reasonable minimum of rock protection. The area is subject to rapid pool drawdown during the summer months. Wilder Pool impounds only about 0.2 inches of storage and looks and behaves much like a free flowing river in the spring with high river velocities. In the more than 20 years that the revetment has been in place it has generally stood up well. There are localized failures, however, which reportedly have occurred in recent years.

The Corps proposes to examine NEPCO's design for the protective works and estimate present day costs of doing a similar job. The revetment will be thoroughly examined to ascertain how well it has stood up through the years. Soil conditions and hydrologic conditions in the area will be examined to determine the stability of the bank and those forces acting upon the bank.

SITE 2 - THETFORD, VERMONT

The owner of this property on the Connecticut River has placed rubber tires along about 150 feet of Bank. The tires are placed within the normal operating range of the hydroelectric pool which is controlled by Wilder Dam some 15 miles downstream. The tires are not tied together but the voids were apparently filled with rounded boulders. Wilder Dam is operated during high flow periods to maintain a minimum pool elevation, however, there is a definite hydraulic control about a mile upstream of Wilder Dam and the normal spring river profile considerably exceeds the normal high water at the site and goes over the protective works. The bank extends about 20 feet, vertical, above the normal high water and the top of the protective works.

Rubber tires are also used to protect the bank in Orford, New Hampshire several miles upstream on the Connecticut River from the previously mentioned section. The Orford site, while only about 50 feet long, is in a more actively eroding bank. Again the tires are placed in the normally active zone of pool fluctuation. These tires, placed three years ago, are along a bank only about five feet high. The tires are staggered in each lift and interlocked by two vertical steel rods through the hole of each tire. The holes were then filled with a uniformly graded trap rock. Spring high flows greatly exceed the top elevation of this protective work.

These sites will be examined to see how they are constructed. An assessment of the soil and hydraulic conditions will be made to see what forces are acting on the revetment and records will be kept indicating how the project behaves through the monitoring period. A history of maintenance work (if any) will be informative.

SITE 3 - TURNERS FALLS POOL, MASSACHUSETTS

Northeast Utilities (NU) constructed a pump-storage electric facility at Northfield Mountain which uses the Turners Falls pool as the lower impounded. Turners Falls pool was raised 5.5 feet in 1973 to accommodate the pump-storage operation. Streambank erosion began to accelerate in 1973 and this area is one of the most actively eroding reaches of the Connecticut River today. The Corps has submitted a project proposal within the pool for construction under Section 32.

NU acknowledges that much of the problem is a result of power pool operations. The Company has undertaken a $600,000 program of bank stabilization which began this fall with the cutting of trees which are falling into the river. Several particularly bad areas have been armored. The Company plans to hydroseed the cleared in the spring of 1977. Hydroseeding is particularly interesting since it is fast, inexpensive, and can be accomplished in areas away from highway access. NU now estimates that hydroseeding will cost in the neighborhood of $3 per running foot of bank ($15,000 per mile).

Corps monitoring of this work would be on a river reach basis as many discontinuous areas of different soil, and hydrologic conditions will be involved. The techniques employed are certainly unique and need evaluation for application in other areas. For instance, the cut trees were removed from the river bank by helicopter and dropped at a central site for grinding. A cost of $12,000 per mile of bank were reported by NU, whereas conventional tree removal would have cost an estimated $20,000 by river barge or $30,000 by land removal. Unique also, are the companies plans to hydroseed. Seed will be applied from a barge on the river. Seed will consist of a mix of grasses, crown vetch, basket willow and brush. The seed will be applied with water, fertilizer, lime, mulch, and a binder. The mix will form a crust which is expected to withstand rain until the grasses germinate and root. Slower germinating but hardier species of grass and brush in the mix will gradually replace the earlier growth.

NU will of course be monitoring the work because of the sizeable investment. Company plans do not, however, include the in-depth monitoring that is necessary to document the success of the program if it is to be recommended for use by others.

The Company is enthusiastic to have the Corps get involved in the program, in fact an exchange of river survey information between the Corps and the Company has already taken place.

SITE 4 - HAVERHILL, NEW HAMPSHIRE

The U. S. Soil Conservation Service (SCS) has assisted several farmers in applying vegetative cover to eroding banks. SCS provides the seed and technical information and the landowner (farmer) provides the necessary labor. The New England Division proposes to work closely with SCS and monitor at least two of these areas and prepare a report on the techniques used and their success.

A reach of particularly active bank in Haverhill was selected by SCS for experiments with several species of grass and willow trees. The downstream half of the study area was planted with seed and young trees. The upper half of the eroded reach was left untreated and is being monitored as the without condition. Various combinations of seed and small trees were applied on 25 foot long test plots. The project has now been underway for three years and some of the larger species are beginning to mature.

A similar program but on a much less active bank was undertaken in Piermont, New Hampshire. Here basket willow was applied on a low bank. The willows were planted in an area which already had a natural grass cover.

Most of the Corps involvement at these sites will consist of periodically inspecting the areas and reporting the success (or lack of success) of the various trial plantings. The record of river flows in the past will be examined to determine the severity of forces which have acted on the bank. The record will, of course, be maintained throughout the monitoring period.

SCS is maintaining records of this program and will at some time probably issue a report. The New England Division feels, however, that the added detail of monitoring which can be provided under Section 32 will be extremely valuable in getting the most out of the program.